Waubee Lake Vegetation Management Plan Update

Kosciusko County, Indiana

2006

http://129.79.145.7/arcims/statewide%5Fmxd/viewer.htm

Prepared for:

The Waubee Lake Association
P. O. Box 275
Milford, IN 46542

Prepared by:

Aquatic Weed Control
P. O. Box 325
Syracuse, IN 46567

Executive Summary

Two aquatic vegetation surveys were conducted on Waubee Lake in 2006. The first survey was conducted on May 17, 2006 and the second was conducted on July 27, 2006. The purpose of these surveys was to document any changes in the plant community from the 2005 surveys, and to monitor the lake's Eurasian watermilfoil (EWM) population, along with the diverse native plant community.

Approximately 10 acres of Waubee Lake were treated with the herbicide Renovate (active ingredient: tryclopyr) on June 22, 2006. This treatment was aimed at helping to control the Eurasian watermilfoil population in Waubee Lake. Eurasian watermilfoil is most abundant in the kettle area at the southwest end of Waubee Lake. This area was treated along with a small section of shoreline on the north side of the lake, as well as a very small channel adjacent to the main lake. The large man-made bay on the northwest side of the lake was treated as well, with private funding. These treatments are not expected to eliminate Eurasian watermilfoil in Waubee Lake but appear to be helping prevent the spread of the invasive plant.

The July 2006 survey found that Eurasian watermilfoil was effectively being controlled in the treatment areas, although there are still many areas of the lake where Eurasian watermilfoil is occasionally collected.

The 2007 management strategies will focus on the same areas to further reduce the Eurasian watermilfoil population. Thus far, results have been encouraging, and the management practices should be continued. The further reduction of the Eurasian watermilfoil population should continue to help beneficial native plants compete and promote a more diverse plant community that offers better fish habitat and less interference to recreational boaters.

Waubee Lake has been intensely surveyed over the past 3 years. In 2007 visual inspection should be adequate to determine the timing and location of treatments. Reducing survey intensity in 2007 should reduce cost to the association, pending LARE requirements. Periodic follow up surveys may be conducted in the following years to monitor the plant community in Waubee Lake.

2007 Cost Estimates

1. Chemically treat areas infested by Eurasian milfoil.

*All cost figures are estimates only. All prices are subject to change pending 2007 chemical pricing.

   A. Treat 10 acres of Eurasian milfoil with Renovate $ 6,000

2. Visually inspect lake to monitor EWM and time treatment $0

3. 2007 Plan Update Up to $3,000

Acknowledgements

Aquatic vegetation surveys conducted on Waubee Lake were made possible by funding from the Waubee Lake Association and the Indiana Department of Natural Resources through the Lake and River Enhancement Program. Aquatic Weed Control would like to extend special thanks to Indiana Department of Natural Resources (IDNR) District 3 biologist Jed Pearson for providing procedural training for both Tier I and Tier II aquatic vegetation surveys. Gwen White and Angela Sturdevant, aquatic biologists for the IDNR Division of Fish and Wildlife provided valuable consultation regarding the requirements and objectives of this lake management plan. Brad Fink, and Jason Doll provided assistance and training for data analysis computer programs. Aquatic Weed Control would also like to thank the members of the Waubee Lake Association for their commitment to improving this lake and for valuable discussion and input brought forward at the informational meeting held on August 19, 2006.

Table of Contents

List of Figures

List of Tables

1.0 Introduction

Waubee Lake has been involved in the Lake and River Enhancement Program (LARE) since 2004, when the first LARE funded aquatic vegetation survey took place on August 12, 2004. Based on the results of this survey Eurasian watermilfoil was very prevalent in some areas of Waubee Lake, and the heaviest areas of infestation were targeted for herbicide treatments. The following chart summarizes all LARE funded activities on Waubee Lake.

Table 1: Waubee Lake LARE History

Year	Action	Date	Funding Source
2004	Late Season Aquatic Vegetation Survey. Lake Management Plan Development	Late Season Survey August 12, 2004	Lake and River Enhancement Waubee Lake Association
2005	Spring and Late Season Aquatic Vegetation Surveys as well Renovate application and Management Plan Update	Spring Survey May 12, 2005 Renovate Application ~10 acres - June 9, 2005 Late Season Survey July 22, 2005	Lake and River Enhancement Waubee Lake Association
2006	Spring and Late Season Aquatic Vegetation Surveys as well Renovate application and Management Plan Update	Spring Survey May 17, 2006 Renovate Application ~10 acres June 22, 2006 Late Season Survey July 27, 2006	Lake and River Enhancement Waubee Lake Association

2.0 Watershed and Lake Characteristics Update

(See 2004 Lake Management Plan)

Secchi disk readings remain acceptable in Waubee Lake at around 9 feet. There have been no known significant changes to the watershed and water quality remains stable.

3.0 Lake Uses Update

(See 2004 Lake Management Plan)

Waubee Lake continues to receive very high levels of public use during the summer months. Boaters and fishermen enter the lake from the public access on Waubee Lake. The lake has a 10 mph speed limit that helps to keep boat traffic to an acceptable level.

4.0 Fisheries Update

The IDNR has conducted a new fisheries survey on Waubee Lake in 2006. The following species list was provided by District 3 Fisheries Biologist Jed Pearson. It summarizes population statistics for every species of fish collected at Waubee Lake in 2006.

Bluegills are the most abundant fish by number and the second most abundant fish by weight. They increased from 44.1 % of the catch in 1985 to 62.5 % of the catch in 2006. Largemouth bass are second by number, and first by weight. Black crappie showed a dramatic decline in numbers from 1995 to 2006. In 1995, 87 crappies were collected in the survey, while only 2 crappies were collected in 2006. Yellow perch also showed a decline from 59 fish to 22 fish in 2006.

Table 2: IDNR Fish Species List

Relative Abundance, Size and Estimated Weight of Fish Collected at Waubee Lake						
			Minimum	Maximum		
Common Name*	Number	Percent	Length (in)	Length (in)	Weight (lb)**	Percent
Bluegill	629	62.5	2.2	7.8	37.35	16.3
Largemouth bass	128	12.7	1.8	20.3	68.47	29.8
Redear	62	6.2	2.9	10.8	14.76	6.4
Rock bass	33	3.3	2.3	8.4	3.94	1.7
Yellow bullhead	31	3.1	1.9	13.9	19.75	8.6
Yellow perch	22	2.2	3.9	5.6	1.17	0.5
Longear	19	1.9	2.2	4.5	0.54	0.2
Brook silverside	17	1.7	3.0	3.5	0.03	0.0
Warmouth	16	1.6	2.6	7.7	3.46	1.5
Green sunfish	9	0.9	2.2	4.7	0.16	0.1
Brown bullhead	6	0.6	11.0	13.6	6.01	2.6
Channel catfish	4	0.4	16.0	20.3	9.28	4.0
Carp	4	0.4	12.9	16.8	7.71	3.4
Spotted gar	4	0.4	14.8	22.4	4.05	1.8
Walleye	3	0.3	21.5	26.3	12.87	5.6
Longnose gar	3	0.3	29.7	39.5	10.33	4.5
Northern pike	3	0.3	20.0	28.2	10.25	4.5
White sucker	3	0.3	13.0	18.9	5.84	2.5
Spotted sucker	2	0.2	18.2	18.6	5.32	2.3
Black crappie	2	0.2	5.6	12.3	1.09	0.5
Bowfin	1	0.1	25.2		5.69	2.5
Smallmouth bass	1	0.1	14.0		1.37	0.6
Hybrid sunfish	1	0.1	6.5		0.20	0.1
Grass pickerel	1	0.1	5.0		0.03	0.0
Logperch	1	0.1	4.3		0.02	0.0
Bluntnose minnow	1	0.1	2.6		0.01	0.0
TOTAL	1006				229.70	
*Common names of fishes recognized by the American Fisheries Society.						
**Weights estimated from standard length-weight regression models.						

5.0 Problem Statement

Eurasian watermilfoil will continue to be the major challenge in maintaining a healthy plant community at Waubee Lake. Herbicide treatments provide effective control on a yearly basis for Eurasian watermilfoil in the heaviest areas of infestation.

6.0 Management Goals and Objectives

The management goals outlined by the IDNR Division of Fish and Wildlife have not changed. They are restated below:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.

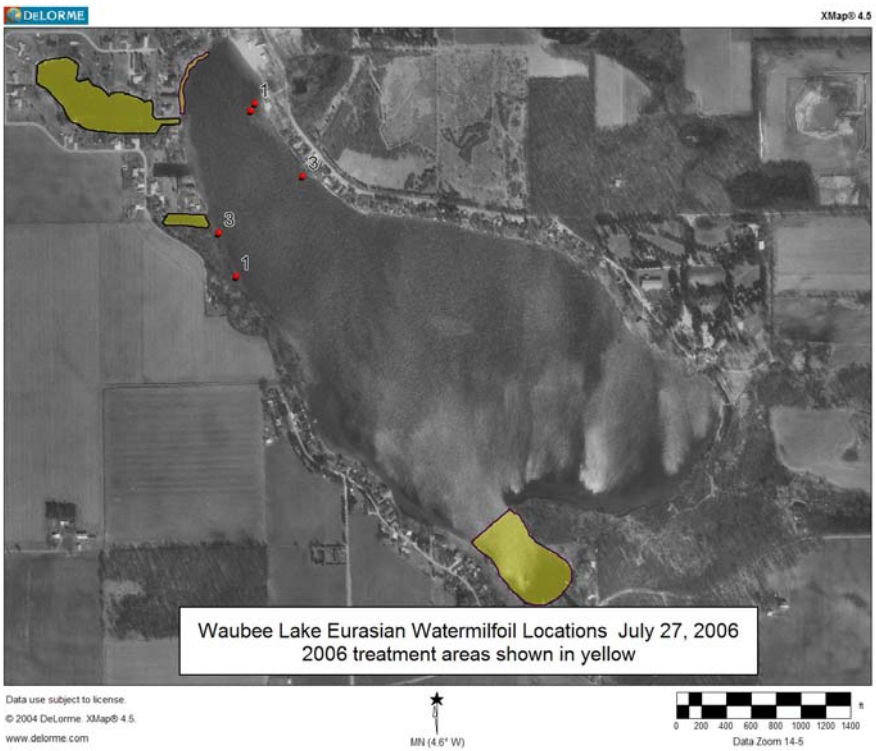
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.

3. Provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

7.0 Plant Management History Update

The major changes to the plant management history have been the LARE funded Renovate treatments for Eurasian watermilfoil. Permit acreages for the treatment of private lots have not changed significantly. A treatment map (Figure 1) shows an outline of the 2006 treatment areas, along with each sample site where Eurasian watermilfoil was collected in the July of 2006. The large man-made bay at the northwest corner of the lake was treated with private funds, while the other areas were treated with LARE funding.

Figure 1: 2006 Treatment Areas



8.0 Aquatic Plant Community Characterization Update

Two major changes have been adopted in LARE protocol that change the process of characterizing the plant community of Indiana lakes.

The first change is the switch from 2 Tier II surveys each year to just one Tier II survey per year. Prior to 2006, both a Tier I and a Tier II survey were required in both spring and July. This year's protocol changed to require a Tier I survey each spring, and A Tier II survey if the July, accompanied by a Tier I July survey to document any changes in the to plant community from spring to July.

The second change is in the formation of a new Tier II protocol. These changes are outlined in the methods section (8.1).

8.1 Methods Update

The Tier II survey protocol was changed by the IDNR in 2006. New LARE Tier II protocol requires that sample sites be stratified by depth contour. Prior to 2006 sites were to be spaced evenly through the littoral zone.

Before 2006, the number of sample sites required each lake were determined strictly by lake size. In the 2006 protocol, the number of sample sites needed is based on both lake size and trophic state. Trophic state describes the productivity of a lake and is correlated with plant growth, secchi disk, and nutrient availability. There are 4 different trophic states listed by the IDNR: Oligotrophic, Mesotrophic, Eutrophic, and Hypereutrophic. Oligotrophic Lakes usually have clear water and few nutrients, while Hypereutrophic lakes usually have deeply stained water and are nutrient rich. Table 3 is taken from the IDNR 2006 Tier II protocol and shows the maximum depth that must be sampled for a lake in each trophic state. In oligotrophic lakes, where water is clear, plants may be able to grow in up to 25 feet of water because sunlight may still reach the lake bottom in deep water. In hypereutrophic lakes where water is turbid, lack of sunlight will prevent plants from growing in deep water, so the maximum sampling depth is only 10 feet.

Table 3: Sample depth by Trophic State

Trophic State	Maximum Depth of Sampling (ft)
Hypereutrophic	10
Eutrophic	15
Mesotrophic	20
Oligotrophic	25

Table 4 is used to calculate the number of sample sites need in each depth contour by using lake size and trophic status. The new protocol attempts to more accurately describe the entire littoral zone of a lake and provide more detailed data analysis by separating the littoral zone into 5 foot depth segments.

Table 4: Sample Sites by Lake Size and Trophic State

Tier II Sampling 3

Table 3. Sample size requirements as determined by lake size, trophic state, and apportioned by depth class.

		Hypereutrophic		Eutrophic			Mesotrophic				Oligotrophic				
Lake Acres	Total # of Sites	0-5 foot contour	5-10 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	20-25 foot contour
<10	20	10	10	10	7	3	10	5	3	2	10	4	3	2	1
10-49	30	20	10	10	10	10	10	10	7	3	10	10	5	3	2
50-99	40	30	10	17	13	10	10	10	10	10	10	10	10	7	3
100-199	50	40	10	23	17	10	14	14	12	10	10	10	10	10	10
200-299	60	50	10	30	20	10	18	16	16	10	14	12	12	12	10
300-399	70	60	10	37	23	10	22	20	18	10	17	15	14	14	10
400-499	80	70	10	43	27	10	25	23	22	10	19	18	17	16	10
500-799	90	80	10	50	30	10	29	27	24	10	22	21	19	18	10
>=800	100	90	10	57	33	10	33	31	26	10	25	23	22	20	10

Waubee Lake is classified as oligotrophic, and has 187 surface acres. Based on these categorizations, 50 sample sites were divided among each 5 foot depth contour to a maximum sampling depth of 25 feet.

8.2.1 Tier I Results

The submersed plant community of Waubee Lake covers roughly 32.5 acres of the lake, or 17.3% of the lake's total surface area. Waubee Lake has a fairly well balanced native plant community, with coontail and chara being the most dominant plants in the lake. Chara dominates much of the shallow water less than 5 feet deep, while coontail dominates much of the deeper water from 8-15 feet.

During the 2006 Tier I surveys, 6 major plant beds were identified. The composition of these plant beds show slight changes from spring to July. Curly leaf pondweed drops out of many plant beds as water temperatures rise, and Eurasian watermilfoil is usually most prevalent in Waubee Lake late spring and early summer.

Problem Plant Areas:

Although Eurasian watermilfoil is present in Waubee Lake, herbicide treatments appear to be controlling the Eurasian watermilfoil in the areas of heaviest infestation. The most problematic area is the kettle at the southwest corner of the lake. The bottom content is silted, making it a conducive to growth of invasive species like Eurasian watermilfoil and curly leaf pondweed.

Beneficial Plant Areas:

One of the most beneficial plant areas in Waubee Lake is the undeveloped wetland and forest area along the south shore of the lake (south of plant bed #5, figure 2). Wetland areas provide excellent water filtration and shoreline stability. This area should be protected to help preserve good water quality in Waubee Lake.

Figure 2: 2006 Tier I Plant Beds

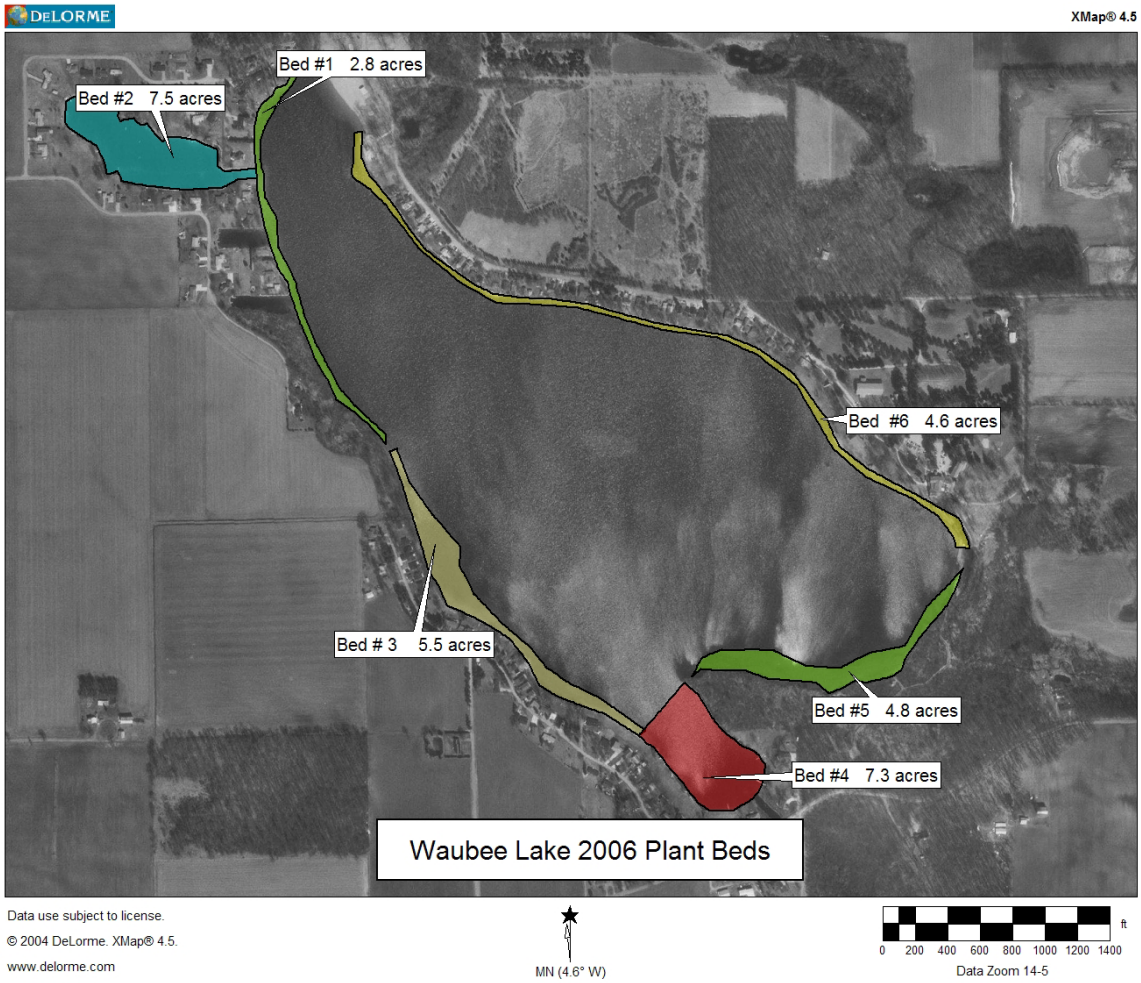


Table 5 shows all of the plant species found in the Tier I surveys and there abundance rating in each plant bed. Blanks indicated that the plant was not present in a particular bed.

Table 5: Tier I Plant Bed Summary

Waubee Lake 2006 Tier I Submersed Plants

May 17 and July 27, 2006	Species Abundance by Plant Bed #					
	#1	#2	#3	#4	#5	#6
Plant Species						
Chara	2	1	3	1	3	2
Illinois Pondweed			1		1	
Eurasian Milfoil	2	2	1	3		
Duckweed				1		
Waterstargrass	1					1
Richardson's Pondweed		1				
Sago Pondweed				1		
Largeleaf Pondweeed						1
Curly-Leaf Pondweed	1			4	1	1
Coontail			1	2	1	1
Total # of Species	**4**	**3**	**4**	**6**	**4**	**5**
Size (Acres)	*2.8*	*7.5*	*5.5*	*7.3*	*4.8*	*4.6*

Plant Bed #1
Size: 2.8 acres
Substrate: Sand/Silt
Number of Species: 4
Description: This plant bed is located along the north end of the lake. The drop-off is abrupt making this plant bed very narrow. Four plant species were found here in spring of 2006. Chara and Eurasian watermilfoil were the 2 most abundant plants in this bed, while waterstargrass and curly leaf pondweed were also found in lower abundance.

Plant Bed #2
Size: 7.3 acres
Substrate: Sand/Silt
Number of Species: 3
Description: This plant bed makes up the large man-made bay at the northwest corner of the lake. In spring, 3 plant species were observed. Eurasian milfoil was present in low abundance, as well as chara and Richardson's pondweed.

Plant Bed #3
Size: 5.5 acres
Substrate: Sand/Silt
Number of Species: 4
Description: This plant bed runs along much of the west shoreline of the lake. Four plant species were observed in this bed. Chara was most abundant, being present in over 60% of the bed. Eurasian watermilfoil, coontail, and Illinois pondweed were all observed in lesser abundance.

Plant Bed #4
Size: 7.3 acres
Substrate: Silt/Sand
Number of Species: 6
Description: This plant bed is made up of the kettle in the southwest corner of the lake. In spring, 6 plant species were observed in this bed. Curly leaf pondweed abundance appears to have increased from 2005, and was the most abundant plant in the bed. Eurasian watermilfoil was also prevalent in this bed. Coontail was present in about 20% of the bed. Chara, sago pondweed and duckweed were all present in lower abundance.

Plant Bed #5
Size: 4.8 acres
Substrate: Sand/Silt
Number of Species: 4
Description: This plant bed runs along the wooded shoreline on the south side of the lake. Chara was the dominant plant in this bed, occupying over 60% of the area. Curly leaf pondweed, Illinois pondweed, and coontail were all present in much lesser abundance.

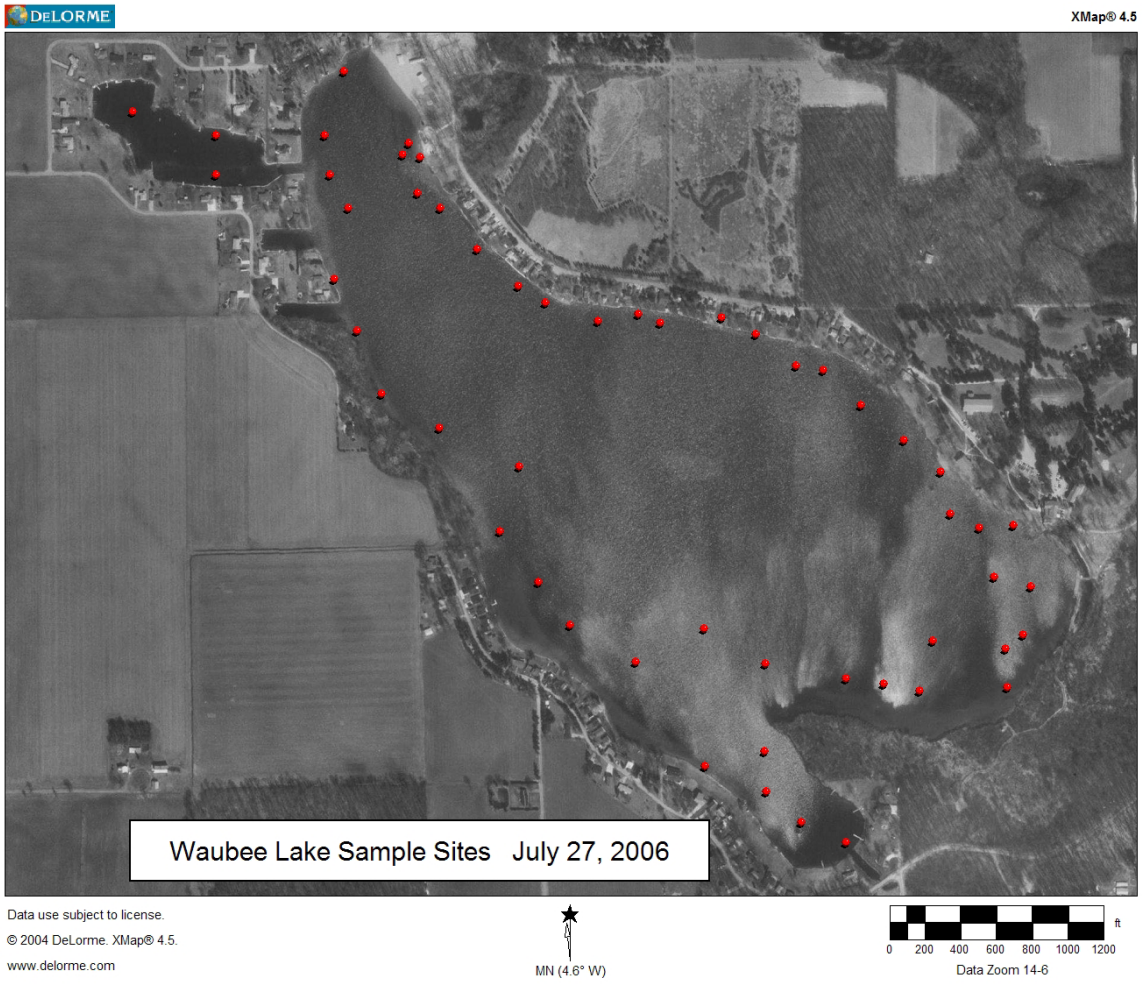
Plant Bed #6
Size: 4.6 acres
Substrate: Sand/Silt
Number of Species: 5
Description: This narrow plant bed runs along most of the eastern shoreline of the lake. This area has a very abrupt drop-off, reducing plant growth. Five plant species were observed. Chara

was the mot abundant plant, especially in water less than 5 feet deep. Large leaf pondweed, coontail, curly leaf pondweed, and waterstargrass were also present in lower abundance.

8.2.2 Tier II Results

Secchi depth was estimated at 9.0 feet in the July 2006 Tier II survey. Fifty rake samples were distributed throughout each 5 foot depth contour of the littoral zone. A total of 10 species of submersed aquatic plants were collected during this survey, with 8 of the 10 species being native plants. The following map shows the locations of all sample sites during the 2006 Tier II survey. Sample sites differ from 2005, reflecting the change in Tier II protocol for 2006.

Figure 3: Waubee Lake 2006 Tier II Sample Sites



Tier II Data Analysis

Tables 6 through 10 are data summaries for the 2006 Tier II aquatic vegetation survey. These tables help to describe the plant community, and will help identify any changes that take place in the years to come. Table 6 includes every sample site in the survey, while the other tables describe each five foot depth contour of the lake's littoral zone (0-5 feet, 5-10 feet, etc).

Calculations for table six include null values for each sample site where no plants were collected.

Table 6: July 2006 Data Analysis: all sites

Occurrence and Abundance of Submersed Aquatic Plants

Date:	7/27/06	Littoral sites with plants:	35	Species diversity:	0.87
Littoral depth (ft):	25.0	Number of species:	10	Native diversity:	0.86
Littoral sites:	50	Maximum species/site:	7	Rake diversity:	0.84
Total sites:	50	Mean number species/site:	1.92	Native rake diversity:	0.83
Secchi:	9.0	Mean native species/site:	1.82	*Mean rake score:	2.82

Common Name	Site frequency	Rel. Freq	Relative density	Mean density	Dominance
Coontail	42.0	21.9	1.14	2.71	22.8
Chara	30.0	15.6	0.98	3.27	19.6
Flat-stemmed Pondweed	22.0	11.5	0.30	1.36	6.0
Illinois Pondweed	22.0	11.5	0.30	1.36	6.0
Brittle Naiad	18.0	9.4	0.54	3.00	10.8
Slender Naiad	18.0	9.4	0.26	1.44	5.2
Waterstargrass	12.0	6.3	0.24	2.00	4.8
Eel Grass	10.0	5.2	0.22	2.20	4.4
Eurasian Watermilfoil	10.0	5.2	0.18	1.80	3.6
Sago Pondweed	8.0	4.2	0.16	2.00	3.2

Table 7: July 2006 Data Analysis: 0-5 foot depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	7/27/206	Littoral sites with plants:	10	Species diversity:	0.84
Littoral depth (ft):	5.0	Number of species:	10	Native diversity:	0.83
Littoral sites:	10	Maximum species/site:	6	Rake diversity:	0.69
Total sites:	10	Mean number species/site:	3.50	Native rake diversity:	0.68
Secchi:	9.0	Mean native species/site:	3.40	*Mean rake score:	5.00

Common Name	Site frequency	Relative density	Mean density	Dominance
Chara	90.0	4.10	4.56	82.0
Illinois Pondweed	70.0	0.90	1.29	18.0
Coontail	60.0	1.00	1.67	20.0
Slender Naiad	40.0	0.40	1.00	8.0
Brittle Naiad	30.0	0.30	1.00	6.0
Flat-stemmed Pondweed	20.0	0.40	2.00	8.0
Eel Grass	10.0	0.30	3.00	6.0
Eurasian Watermilfoil	10.0	0.10	1.00	2.0
Sago Pondweed	10.0	0.10	1.00	2.0
Waterstargrass	10.0	0.30	3.00	6.0

Table 8: July 2006 Data Analysis: 5-10 Foot Depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	7/27/06	Littoral sites with plants:	10	Species diversity:	0.89
Littoral depth (ft):	10.0	Number of species:	10	Native diversity:	0.88
Littoral sites:	10	Maximum species/site:	7	Rake diversity:	0.84
Total sites:	10	Mean number species/site:	3.30	Native rake diversity:	0.83
Secchi:	9.0	Mean native species/site:	3.20	*Mean rake score:	4.60

Common Name	Site frequency	Relative density	Mean density	Dominance
Brittle Naiad	50.0	2.10	4.20	42.0
Coontail	50.0	1.70	3.40	34.0
Chara	40.0	0.60	1.50	12.0
Flat-stemmed Pondweed	40.0	0.40	1.00	8.0
Eel Grass	30.0	0.70	2.33	14.0
Illinois Pondweed	30.0	0.50	1.67	10.0
Sago Pondweed	30.0	0.70	2.33	14.0
Waterstargrass	30.0	0.50	1.67	10.0
Slender Naiad	20.0	0.20	1.00	4.0
Eurasian Watermilfoil	10.0	0.30	3.00	6.0

Table 9: July 2006 Data Analysis:10-15 foot Depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	7/27/06	Littoral sites with plants:	9	Species diversity:	0.85
Littoral depth (ft):	15.0	Number of species:	9	Native diversity:	0.82
Littoral sites:	10	Maximum species/site:	4	Rake diversity:	0.79
Total sites:	10	Mean number species/site:	2.00	Native rake diversity:	0.75
Secchi:	9.0	Mean native species/site:	1.70	*Mean rake score:	3.10

Common Name	Site frequency	Relative density	Mean density	Dominance
Coontail	50.0	1.70	3.40	34.0
Flat-stemmed Pondweed	40.0	0.60	1.50	12.0
Eurasian Watermilfoil	30.0	0.50	1.67	10.0
Chara	20.0	0.20	1.00	4.0
Waterstargrass	20.0	0.40	2.00	8.0
Brittle Naiad	10.0	0.30	3.00	6.0
Eel Grass	10.0	0.10	1.00	2.0
Illinois Pondweed	10.0	0.10	1.00	2.0
Slender Naiad	10.0	0.50	5.00	10.0

Table 10: July 2006 Data Analysis: 15-20 Foot Depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	7/27/06	Littoral sites with plants:	6	Species diversity:	0.53
Littoral depth (ft):	20.0	Number of species:	3	Native diversity:	0.53
Littoral sites:	10	Maximum species/site:	2	Rake diversity:	0.32
Total sites:	10	Mean number species/site:	0.80	Native rake diversity:	0.32
Secchi:	9.0	Mean native species/site:	0.80	*Mean rake score:	1.40

Common Name	Site frequency	Relative density	Mean density	Dominance
Coontail	50.0	1.30	2.60	26.0
Slender Naiad	20.0	0.20	1.00	4.0
Flat-stemmed Pondweed	10.0	0.10	1.00	2.0

No plants were found in the 20-25 foot depth contour.

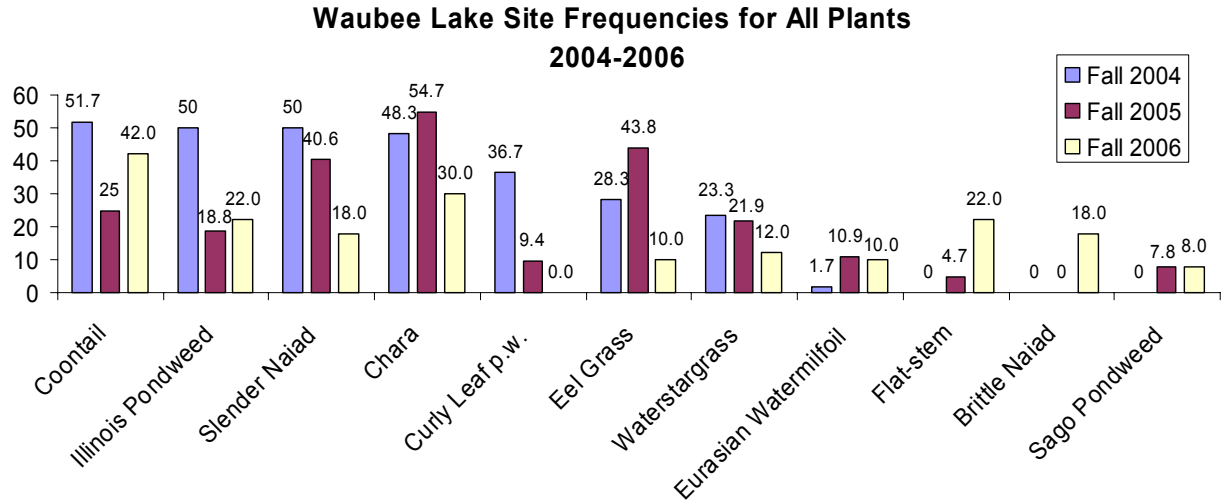
Site Frequency

Site frequency is a measure of how often a species was collected during the Tier II survey. It can be calculated by the following equation:

$$\text{Site Frequency} = \frac{(\text{\# of sites where the species was collected})}{\text{Total \# of littoral sample sites}} \times 100$$

Table 11 shows site frequencies for every plant collected in any of the late season Tier II surveys since the lake was involved in the LARE program. Eurasian watermilfoil has remained constant since 2004, as the July 2004 survey was conducted after herbicide treatments. Changes in site frequencies also reflect the change in Tier II protocol, with many plants that grow in deeper water being collected more frequently in July of 2006.

Table 11: 2004-2006 Site Frequencies



Mean Density and Relative Density

Mean Density is a measure the abundance of a species in areas where it is growing. For example, a species can have a high site frequency, but still have a very low mean density. This means that a species may be prevalent throughout an entire lake, but it may also be sparsely scattered. Mean density can be calculated using the following equation:

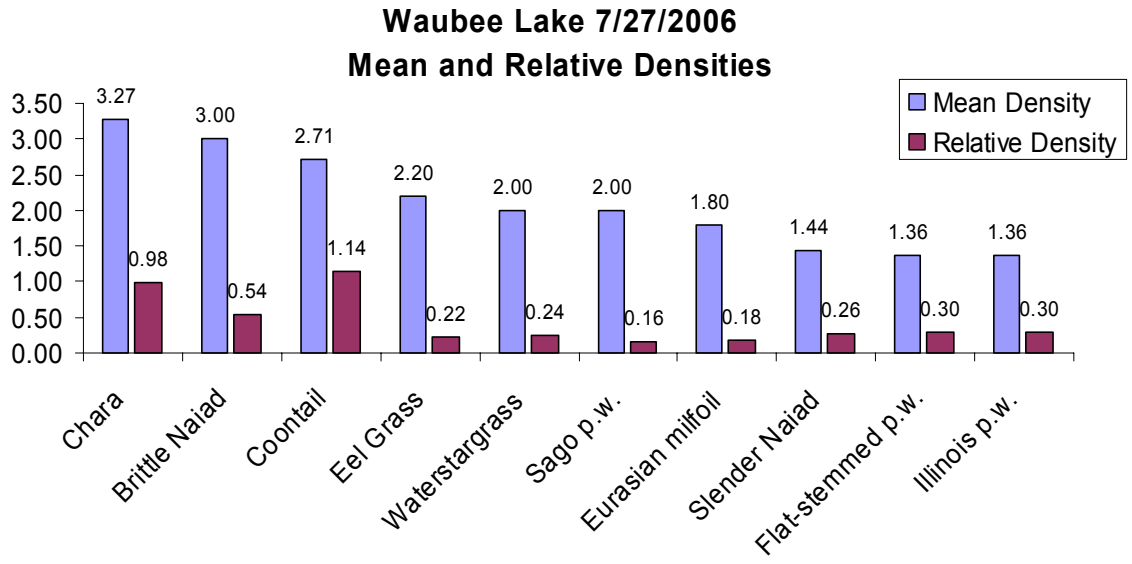
$$\text{Mean Density} = \frac{\text{(The sum of all rake scores for a species)}}{\text{(Total \# of sites where the species was collected)}}$$

Relative Density is calculated much like mean density, only in this case, the sum of the rake scores for a species is divided by the total number of sample sites in the survey. Unless a species was collected at every sample site, the relative density will always be smaller than the mean density.

$$\text{Relative Density} = \frac{\text{(The sum of all rake scores for a species)}}{\text{(Total \# of littoral sample sites)}}$$

Table 12 shows mean and relative densities for each plant found in the July 2006 Tier II survey. Chara had both the highest mean density and the second highest relative density. Brittle naiad had the second highest mean density and the third highest relative density. Eurasian watermilfoil had low densities, with a mean density of 1.8 and a relative density of 0.18.

Table 12: July 2006 Mean and Relative Densities



Species Diversity

The species diversity indices listed in Tables 6 and 10 help to describe the overall plant community. A species diversity index is actually measured as a value of uncertainty (H). If a species is chosen at random from a collection containing a certain number of species, the diversity index (H) is the probability that a chosen species will be different from the previous random selection. The diversity index (H) will always be between 0 and 1. The higher the H

value, the more likely it is that the next species chosen from the collection at random will be different from the previous selection (Smith, 2001). This index is dependent upon species richness and species evenness, meaning that species diversity is a function of how many different species are present and how evenly they are spread throughout the ecosystem.

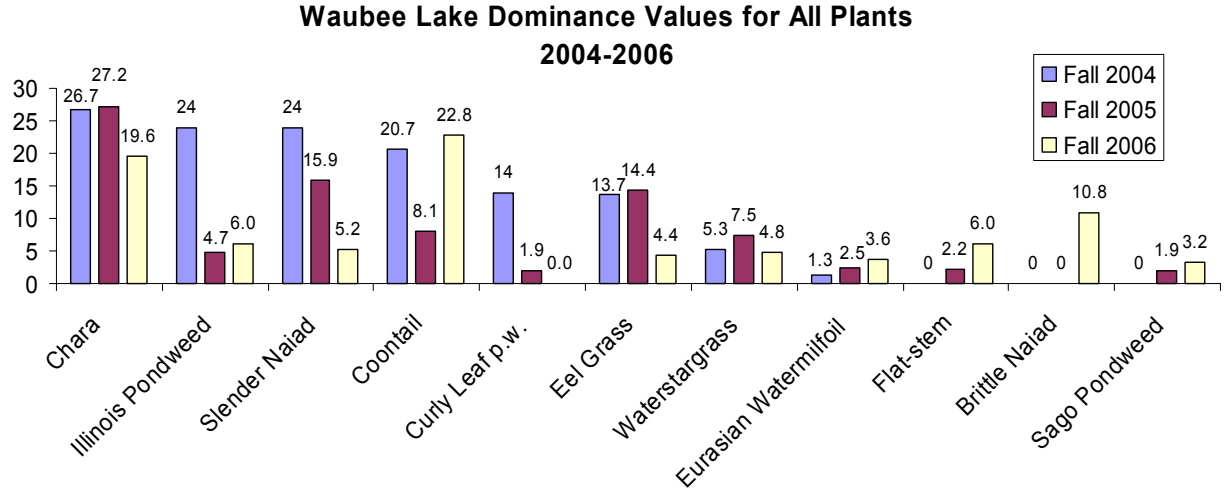
The species diversity index for Waubee Lake in July of 2006 was 0.87 which is above average when compared with area lakes. Native plant diversity in July of 2006 was 0.86 which indicates that most species collected in the survey were native plants. Rake diversity was 0.84 and native rake diversity was 0.83.

Species Dominance

Species dominance is dependent upon how many times a species occurs, and its relative coverage area or biomass within the system. In this survey, the abundance rating given to each species at each sample site was used to determine dominance. The dominance of a particular species in this Tier II survey increases as its site frequency and relative abundance increase.

Table 13 tracks dominance values for each plant collected at Waubee Lake during its involvement in the LARE program. Trends are similar to sight frequency, with Eurasian watermilfoil dominance remaining low. The slight increase in Eurasian watermilfoil dominance from 2004 to 2006 may be to the change in Tier II protocol, as it is usually found in deeper water.

Table 13: 2004-2006 Plant Dominance



Relative Frequency of Occurrence

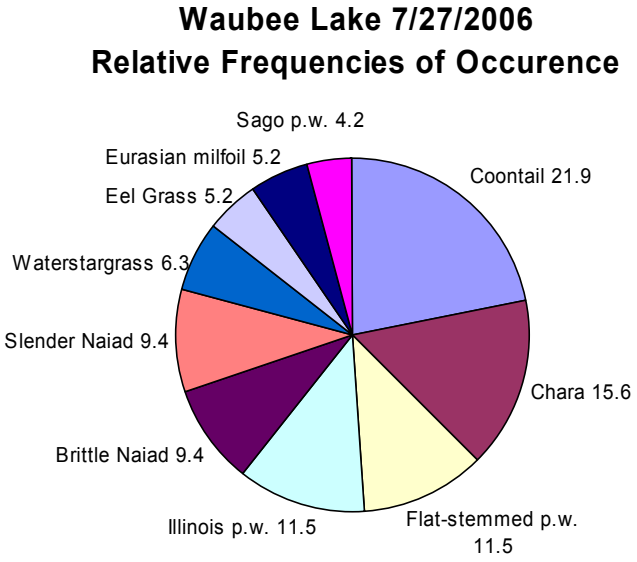
Relative frequency of occurrence is a measure of how often a plant is collected in relation to all of the other plants collected in a Tier II survey. It is demonstrated with the following equation:

$$\text{Relative Freq. of Occurrence} = \frac{\text{The site Frequency for a species} \quad X\ 100}{\text{The sum of all site frequencies including the species in question}}$$

The sum of all relative frequency of occurrence values will always add up to 100. For this reason it is displayed in a pie graph.

Table 14 shows relative frequency of occurrence values for each plant collected in the July 2006 survey. Coontail had the greatest relative frequency at 21.9, while chara was second, with a relative frequency of 15.6. Flat-stemmed pondweed and Illinois pondweed each had relative frequencies of 11.5. Brittle naiad and slender naiad each had relative frequencies of 9.4.

Table 14: July 2006 Relative Frequencies of Occurrence



8.3 Macrophyte Inventory Discussion

The submersed plant community of Waubee Lake covers roughly 32.5 acres of the lake, or 17.3% of the lake's total surface area. This is a fairly small littoral zone when compared to the overall surface area.

Based upon 2006 survey data, Waubee Lake has a submersed aquatic plant community with relatively high diversity when compared with many area lakes. Species richness in Waubee Lake was 10 species in the July of 2006. The plant community is dominated by chara and coontail, which are both beneficial, native plants. Eurasian watermilfoil is present in the lake, although it does not appear to be increasing in abundance. As more data is collected in the years to come, long term trends can be identified, and the health and diversity of the plant community can be more closely tracked.

Based on survey results, the Renovate treatments appear to be successfully preventing the spread of Eurasian watermilfoil in Waubee Lake. Eurasian watermilfoil dominance increased slightly from 2.5 in 2005 to 3.6 in 2006. This may be reflective of a change in survey protocol, which takes a greater number of sample sites in deep water, where Eurasian milfoil often grows.

In summary, Waubee Lake is characterized by a submersed plant community with high diversity (0.87), moderate water clarity (secchi depth ~9 ft.) and a moderately abundant population of Eurasian watermilfoil (site frequency 10%).

9.0 Aquatic Vegetation Management Alternatives

(See 2004 Lake Management Plan)
Major Eurasian watermilfoil control practices have not changed significantly from the 2004 alternatives.

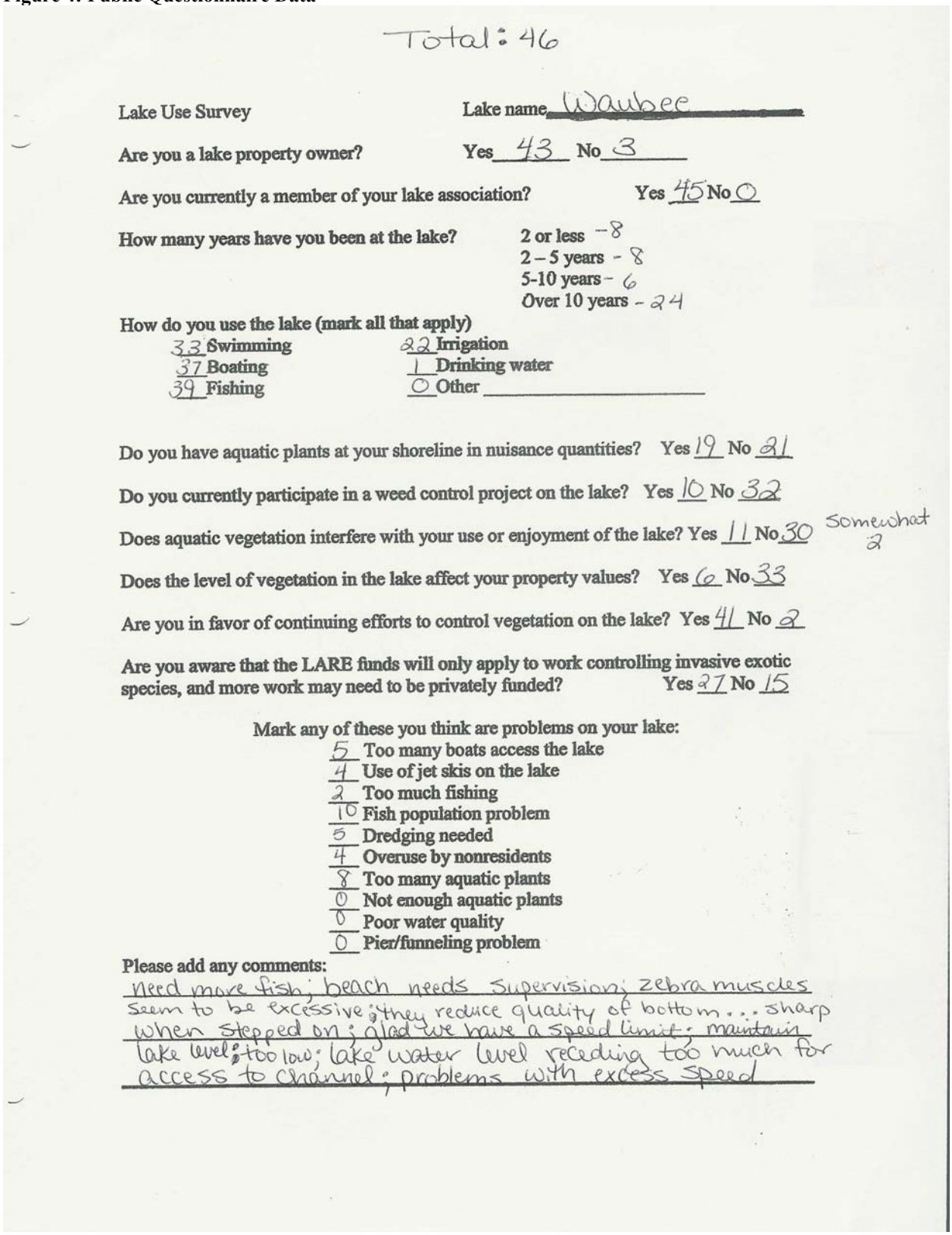
10.0 Public Involvement

A LARE meeting was held on October 31, 2006 to discuss issues pertaining to Waubee Lake. District 3 Fisheries Biologist Jed Pearson, lake representatives, Aquatic Weed Control and LARE Aquatic biologist Angela Sturdevant were all present and discussed the plant community of Waubee Lake. Discussion at this meeting helped to develop the 2007 management strategy.

A public lake meeting was held for Waubee Lake on August 19, 2006. Jim Donahoe of Aquatic Weed Control summarized LARE management activities and outlined the treatment strategy to help contain the Eurasian watermilfoil population in the lake.

Public questionnaires were handed out at the public lake association meeting. Many residents were happy that the Eurasian watermilfoil distribution remains largely in isolated patches and does not appear to be spreading. Among other concerns were the lake level, which has been low in recent years, as well as the presence of zebra mussels in Waubee Lake. Figure 4 is a summary of the 2007 public questionnaires.

Figure 4: Public Questionnaire Data



Total: 46

Lake Use Survey — Lake name Waubee

Are you a lake property owner? Yes 43 No 3

Are you currently a member of your lake association? Yes 45 No 0

How many years have you been at the lake?
- 2 or less – 8
- 2 – 5 years – 8
- 5-10 years – 6
- Over 10 years – 24

How do you use the lake (mark all that apply)
- 33 Swimming
- 37 Boating
- 39 Fishing
- 22 Irrigation
- 1 Drinking water
- 0 Other

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 19 No 21

Do you currently participate in a weed control project on the lake? Yes 10 No 32

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 11 No 30 somewhat 2

Does the level of vegetation in the lake affect your property values? Yes 6 No 33

Are you in favor of continuing efforts to control vegetation on the lake? Yes 41 No 2

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 27 No 15

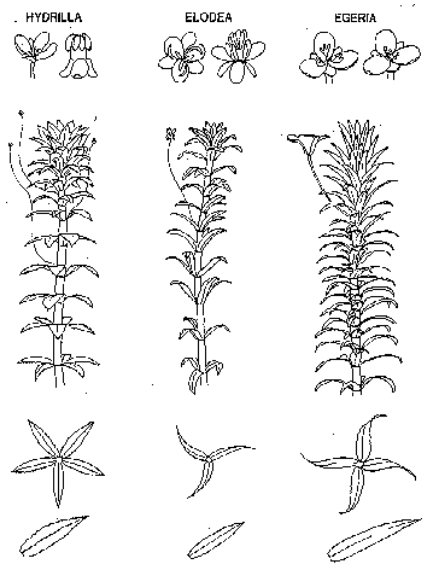
Mark any of these you think are problems on your lake:
- 5 Too many boats access the lake
- 4 Use of jet skis on the lake
- 2 Too much fishing
- 10 Fish population problem
- 5 Dredging needed
- 4 Overuse by nonresidents
- 8 Too many aquatic plants
- 0 Not enough aquatic plants
- 0 Poor water quality
- 0 Pier/funneling problem

Please add any comments:
need more fish; beach needs supervision; zebra muscles seem to be excessive; they reduce quality of bottom... sharp when stepped on; glad we have a speed limit; maintain lake level; too low; lake water level receding too much for access to channel; problems with excess speed

11.0 Public Education

Hydrilla

Hydrilla (*Hydrilla verticillata*) is an invasive aquatic plant species common throughout the southern United States. It is federally listed as a noxious weed and causes severe ecological and recreational problems wherever it grows. It is considered to be much more destructive than other invasives like Eurasian watermilfoil and curly leaf pondweed because of its reproductive adaptations. It grows by fragmentation, as does Eurasian watermilfoil, but it also produces turions which can remain dormant in the sediment for 4 years or more (Van and Steward, 1990). It produces tubers at its root tips which can also reproduce after multiple years of dormancy. It can grow 1 inch each day and it quickly out-competes native plants. It forms dense beds that eliminate native plants, stunt fish populations, impede recreation and cause a drastic decrease in biodiversity (Colle and Shireman, 1980). Millions of dollars are spent each year for hydrilla maintenance each year in Florida alone. Eradication is unlikely once a population has been well established, although eradication has been achieved in newly infested waters using a herbicide called Sonar. Sonar is applied at a rate of 6 parts per billion and this concentration is maintained in the water for 180 days. Early detection can be crucial to an effective eradication program, and all lake residents and users are encouraged to be on the look-out for this invader.



In fall of 2006, this plant was found in Lake Manitou, in Rochester, Indiana. This is the first instance of hydrilla in the upper Midwest. Prior to its appearance in Lake Manitou, The closest infestations of hydrilla were in Tennessee and Pennsylvania.

Hydrilla can easily be confused with native elodea. The major difference is that elodea has sets of leaves on the stem in whorls of three, while hydrilla usually has whorls of 5 leaves, although 4 to 9 leaves per whorl are possible with hydrilla. Hydrilla will also have small serrations on the leaf edges. More information on hydrilla can be found at the University of Florida's Center for Aquatic Invasive Plants (http://plants.ifas.ufl.edu/). More general information on aquatic invaders can be found at www.protectyourwaters.net.

12.0 Integrated Management Action Strategy

Approximately 10 acres of Waubee Lake will be treated again in 2007 using Renovate to provide control of Eurasian watermilfoil. Treatment areas will remain the same in 2007, since Eurasian watermilfoil appears to be contained with the yearly treatments. Survey intensity will be reduced, as the lake has been surveyed intensely in the past three years. Visual inspection will be sufficient to monitor EWM populations to properly time treatments.

13.0 Project Budget

1. Chemically treat areas infested by Eurasian milfoil.

*All cost figures are estimates only. All prices are subject to change pending 2007 chemical pricing.

A. Treat 10 acres of Eurasian milfoil with Renovate $ 6,000

2. Visually inspect lake to monitor EWM and time treatment

A. Visual Inspection for EWM $0

3. 2007 Plan Update Up to $3,000

Survey and planning costs

Three thousand dollars are currently budgeted for surveying and planning but this cost may be less should LARE reduce the survey intensity and planning required.

14.0 Monitoring and plan Update Procedures

Visual inspection should be used in 2007 to monitor the Eurasian watermilfoil population in Waubee Lake. The lake has been surveyed extensively since 2004, and an adequate characterization of the plant community has been developed. Waubee Lake has good water clarity, which makes visual inspections very efficient and effective. This should help reduce costs to the association and still provide an adequate picture of any changes in the plant community. In spring of 2007, visual inspection will be used to determine treatment areas for the year.

15.0 References

Blessing, Arlene. 2004. Fundamentals of Pesticide Use: Indiana Pesticide Applicator Core Training Manual. Purdue University. West Lafayette, Indiana 106 pp.

Cunningham, Willam P., and Saigo, Barwbara W. 2001. Environmental Science: a Global Concern. McGraw Hill Inc. Boston, Massachusetts 646.

Getsinger, Kurt Ph.D. 2005. Aquatic Plant Management: Best Management Practices in Support of Fish and Wildlife Habitat. The Aquatic Ecosystem Restoration Foundation. 78 pp.

IDNR. 2004. Procedure Manual for Surveying Aquatic Vegetation: Tier II Reconnaissance Surveys. IN Department of Natural Resources, Division of Soil Conservation.

IDNR 2004. Procedure manual for surveying Aquatic Vegetation: Tier I and Tier II, Indiana Department of Natural Resources, Indianapolis, Indiana.

Kalff, Jacob. 2002. Limnology: Inland Water Ecosystems. Prentice Hall. Upper Saddle River, New Jersey. 592 pp.

Kannenburg, James R., and Schmidt, James C. 1998. How to Identify and Control Water Weeds and Algae: 5th edition. Applied Biochemists. Milwaukee, Wisconsin. 128pp.

Lembi, Carole 1997. Aquatic Pest Control: Category 5. Department of Botany and Plant Pathology: Purdue University. West Lafayette, Indiana. 58pp.

Pearson, Jed. 2006. Relative Abundance, Size and Estimated Weight of Fish Collected at Waubee Lake. IN Department of Natural Resources. Division of Fish and Wildlife.

Pearson, Jed. 2004. A Proposed Sampling Method to Assess Occurrence, Abundance and Distribution of Submersed Aquatic Plants in Indiana Lakes. IN Department of Natural Resources. Division of Fish & Wildlife. Indianapolis, Indiana 37 pp.

Pullman, Douglas G. 1998. The Lake Association Leaders Aquatic Vegetation Management Guidance Manual.

Scribalio, Robin W. Ph.D. & Alix, Mitchell S. 2003. Final Report on the Weevil Release Study for Indiana Lakes. Department of Botany and Plant Pathology. Purdue University. West Lafayette, IN.

Smith, Robert Leo and Smith, Thomas M. 2001. Ecology and Field Biology. Addison Wesley Longman, Inc. San Francisco, California. 771 pp.

Stern, Kinsingly R. 2000. Introductory Plant Biology. McGraw Hill. Madison, Wisconsin. 557 pp.

Tyllia, J. 2000. Northeastern Indiana Fishing Map Guide. Superior, Wisconsin. 184 pp.

16.0 Appendices
16.1 Common Aquatic Plants of Indiana

The following appendix was compiled using information found in the 5th edition of How to Identify Water Weeds and Algae, edited by James C. Schmidt and James R. Kannenberg. All pictures, with the exception of Illinois pondweed and northern milfoil were taken from the Category 5 Aquatic Pest Control Management Manual, written by Dr. Carole Lembi, Head of the Department of Botany and Plant Pathology at Purdue University.

American Pondweed

Scientific name: *Potamogeton americanus*

Classification: Native to Indiana

Distribution: Common throughout the U.S.

Description: American pondweed can be identified by its oval shaped leaves floating on the top of the water. The base of each leaf tapers to a very long petiole that connects the leaf with the stem of the plant. Plant leaves are arranged alternately on the stem and leaves are usually sparsely scattered.

Chara

Scientific name: *Chara sp*.

Classification: Native to Indiana

Distribution: Extremely common worldwide. Usually found in hard water.

Description: Chara is often mistaken for a vascular plant, but it is actually an advanced form of algae. It can be gray, green or yellow in color and is usually forms extremely dense beds that may cover an entire lake. It can be identified by its distinct musky odor and calcium deposits on the algae's surface make it feel bristly to the touch. It possesses leaf-like structures that are whorled around the hollow stem, and it attaches itself to the lake bottom, although it has no actual roots. It usually grows in shallow, clear water.

Coontail

Scientific name: *Ceratophyllum demersum*

Classification: Native to Indiana

Distribution: Common throughout the U.S., usually in hard water.

Description: Coontail plants are submersed and have no roots, though they appear to be attached to the lake bottom when viewed from above the surface of the water. The free-floating nature of coontail allows it to colonize new areas of a lake quickly, and it often times forms extremely dense weed beds where sufficient light and nutrients are available. Coontail has dark green leaves arranged in whorls around the stem and usually grows in long, bushy strands resembling evergreen trees beneath the surface of the water. Coontail's structure is very similar to Eurasian milfoil but coontail has forked leaves, which distinguishes it from the feather-like projections of milfoil leaves.

Curley Leaf Pondweed

Scientific name: *Potamogeton crispus*

Classification: Exotic to Indiana

Distribution: Found throughout the U.S. in fresh and brackish water.

Description: Curley leaf pondweed usually grows and spreads rapidly in early spring and begins to dies out by midsummer as water temperatures approach 70 degrees Fahrenheit. Curley leaf has extremely thin, membranous leaves arranged alternately on the stem with small teeth-like projections visible along the edge of each leaf. A reproductive spike may be seen protruding from the surface of the water. Curley leaf pondweed may also leave small reproductive structures called turions in the sediment on the lake bottom that can lie dormant throughout the winter and then sprout when spring arrives.

Eel Grass (Wild Celery)

Scientific name: *Vallisneria Americana*

Classification: Native to Indiana

Distribution: Found from the Great Plains to the East Coast of the U.S.

Description: Eel grass has tufts of ribbon-like leaves with a horizontal stem embedded in the sediment connecting each tuft. This native plant grows thick weed beds anchored in the mud by roots. These dense beds often shade out other forms of weeds and provide excellent escape cover for small fish. The flowers of this plant are visible in late summer and sit on the top of a coiled structure protruding to the surface. This plant is found in both lakes and river, but is seldom found in stagnant systems. It is considered an extremely valuable plant to aquatic ecosystems.

Elodea

Scientific Name: *Elodea Canadensis*

Classification: Native to Indiana

Distribution: Common throughout the north and north central united states. Its ranges extends as far south as northern Tennnessee.

Description: Elodea grows in long strands resembling milfoil, but its leaves are broad and oval shaped. Leaves are arranged in whorls with three leaves usually occurring at each node. Leaves near the tip of the plant are closely packed together, with the distance between nodes increasing further down the stem.

Eurasian Milfoil

Scientific Name: *Microphyllum spicatum*

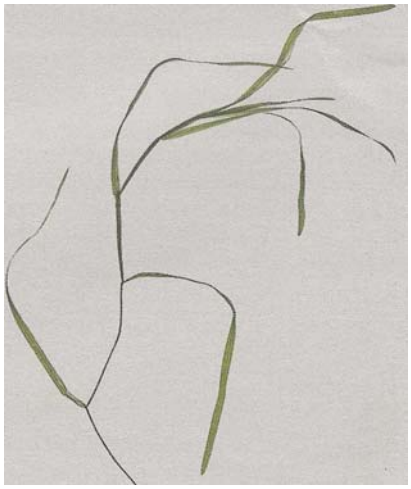
Classification: Exotic in Indiana

Distribution: Common in the Midwest and Eastern U.S. Also spreading along the Pacific coast

Description: This extremely aggressive and extremely destructive plant has leaves in whorls of 4 around a reddish stalk. This plant grows rapidly and can reach lengths of over 10 feet. This plant has the ability to over winter, meaning it can lie dormant during the winter months instead of dying out completely each year. This gives it a distinct advantage over many native species, as it competes for sunlight in early spring. The dormant milfoil plants reach the surface much faster than the native plants sprouting from the lake bottom. This enables the Eurasian milfoil to shade out other plants and form the dense beds that choke the littoral zone of many lakes.

A reproductive process called fragmentation aids the rapid dispersion of Eurasian milfoil. If a milfoil plant is damaged and some fragments are removed from the macrophyte, each small piece of the plant has the ability to grow roots and create a new milfoil plant. Eurasian milfoil is considered one of the most dangerous aquatic nuisance species because of its ability to rapidly disrupt and destroy lake ecosystems.

Flat-stemmed Pondweed



Scientific Name: *Potamogeton zosteriformis*

Classification: Native to Indiana

Distribution: Common throughout the northern half of the U.S.

Description: the most noticeable characteristic is the large, very flat stem. It cannot be rolled between the fingers easily. The ribbon-like leaves extend from the stem toward the surface of the water.

Illinois Pondweed

Scientific name: *Potamogeton illinoensis*

Classification: Native to Indiana

Distribution: Very widespread and very common throughout the upper Midwest and the U.S

Description: Illinois pondweed is common in Indiana, especially in the northern third of the state. This leafy weed has leaves with very broad bases that extend three-fourths of the way around the stem. The upper part of its slender stem is usually branched and very leafy.

www.wvu.edu

Large Leaf Pondweed

Scientific name: *Potamogeton amplifolius*
Classification: Native to Indiana
Distribution: Common throughout the upper Midwest and the northern United States in hard water.

Description: This plant has both submersed and floating leaves. The floating leaves are oval shaped and are similar to those of American pondweed. Submersed leaves are arranged alternately with each leaf becoming extremely narrow as it nears the stem of the plant. Mineral deposits on its leaves often give large leaf pondweed a dark brown appearance.

Naiad

Scientific name: *Najas minor* (brittle naiad)

Classification: Native to Indiana

Distribution: Common throughout the U.S.

Description: The leaves of naiad plants are usually widest at the base and gradually become thinner near the tip of the leaf. Plants are extremely leafy and appear bush-like when viewed from above the surface of the water. Many species of naiad are very common in this area. Plant structure often resembles chara, but the absence of calcium deposits on the surface of the plant help in identification. The leaves of brittle naiad have multiple spines along the margins that are visible to the naked eye.

Nitella

Scientific name: *Nitella sp.*

Classification: Native to Indiana

Distribution: Found worldwide, usually in hard water.

Description: Nitella is very similar to chara, and it is also an advanced form of algae. It has leaf-like projections that are whorled around the stem. It is often found growing in very thick patches, usually in shallow, clear water.

Northern Milfoil

Scientific name: *Myriophyllum sibericum*

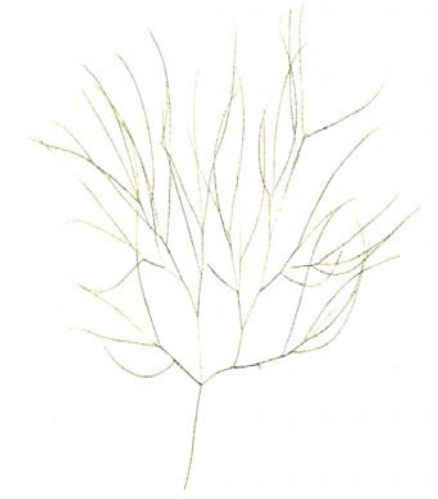
Classification: Native to Indiana

Distribution: Found throughout the northern half of the U.S. and also in Europe and Western Asia

www.io.uwinnipeg.ca

Description: Northern milfoil has submersed, feather-like, whorled leaves that closely resemble the leaves of Eurasian milfoil. Distinguishing the native northern milfoil from Eurasian milfoil can be difficult. The leaflet pairs of northern milfoil are generally fewer and more widely spaced than those of Erasian milfoil. This plant is known to hybridize with Eurasian milfoil, and at times, chemical analysis is necessary to distinguish between the two plants.

Sago Pondweed



Scientific name: *Potemogeton pectinatus*

Classification: Native to Indiana

Distribution: Found throughout the U.S., Common in the northern 2/3 of Indiana.

Description: Sago Pondweed has a bushy appearance with narrow, thread-like leaves that spread out to resemble a fan. Leaves are usually 1/16 of an inch wide and 1 to 6 inches long. Nutlets are formed on a string-like structure and protrude from the surface of the water. While sago pondweed can form dense beds, many times it is found in sparse, loosely distributed arrangements.

16.2 Pesticide Use Restrictions Summary:

The following table was produced by Purdue University and included in the Professional Aquatic Applicators Training Manual. It gives a summary of water use restrictions on all major chemicals available for use in the aquatics market.

Table 15: Pesticide Use Restrictions

Table 1. Aquatic Herbicides and Their Use Restrictions. Always check the label because these restrictions are subject to change.

	Human			Animal	Irrigation		
	Drinking	Swimming	Fish Consumption	Drinking	Turf	Forage	Food Crops
	waiting period, in days						
Copper Chelate	0	0[a]	0	0	0	0	0
Copper Sulfate	0	0[a]	0	0	0	0	0
Diquat	1–3	0[a]	0	1	1–3	1–3	5
Endothall (granular)[b]	7	0[a]	3	0	7	7	7
Endothall (liquid)[b]	7–25	0[a]	3	7–25	7–25[d]	7–25	7–25
Endothall 191 (granular)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Endothall 191 (liquid)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Fluridone	0[e]	0[a]	0	0	7–30	7–30	7–30
Glyphosate	0[e]	0[a]	0	0	0	0	0
2,4-D (granular)	*	0[a]	0	*	*	*	*

[a]Although this compound has no waiting period for swimming, it is always advisable to wait 24 hours before permitting swimming in the direct area of treatment.

[b]Trade name is Aquathol®.

[c]Trade name is Hydrothol®.

[d]May be used for sprinkling bent grass immediately.

[e]Do not apply this product within 1/4 (fluridone) to 1/2 (glyphosate) mile upstream of potable water intakes.

*Do not use treated water for domestic purposes, livestock watering (2,4-D, dairy animals only), or irrigation.

16.3 Resources for Aquatic Management

In addition to the LARE Program, there are many other sources of potential funding to help improve the quality of Indiana Lakes. Many government agencies assist in projects designed to improve environmental quality.

The USDA has many programs to assist environmental improvement. More information on the following programs can be found at www.usda.gov.

Watershed Protection and Flood Prevention Program (USDA

Conservation Reserve Program (USDA)

Wetlands Reserve Program (USDA)

Grassland Reserve Program (USDA)

Wildlife Habitat Incentive Program (USDA)

Small Watershed Rehabilitation Program (USDA)

The following programs are offered by the U.S. Fish and Wildlife Service. More information about the Fish and Wildlife service can be found at www.fws.gov

Partners for Fish and Wildlife Program (U.S. Fish and Wildlife Service)

Bring Back the Natives Program (U.S. Fish and Wildlife Service)

Native Plant Conservation Program (U.S. Fish and Wildlife Service)

The Environmental Protection Agency, the Indiana Department of Environmental Management, and the U.S. Forest Service also have numerous programs for funding. A few of these are listed below. More information can be found at www.in.gov/idem and www.fs.fed.us/

U.S. Environmental Protection Agency Environmental Education Program (EPA)

NPDES Related State Program Grants (IDEM)

Community Forestry Grant Program (U.S. Forest Service)

16.4 State Regulations for Aquatic Plant Management

The following information is found on the IDNR website and outlines general regulations for the management of aquatic plants in public waters.

AQUATIC PLANT CONTROL PERMIT REGULATIONS
Indiana Department of Natural Resources

Note: In addition to a permit from IDNR, public water supplies cannot be treated without prior written approval from the IDEM Drinking Water Section. **Amended state statute adds biological and mechanical control (use of weed harvesters) to the permit requirements, reduces the area allowed for treatment without a permit to 625 sq ft, and updates the reference to IDEM.** *These changes become effective on July 1, 2002.*

Chapter 9. Regulation of Fishing
IC 14-22-9-10

Sec. 10. (a) This section does not apply to the following:
(1) A privately owned lake, farm pond, or public or private drainage ditch.
(2) A landowner or tenant adjacent to public waters or boundary waters of the state, who chemically, mechanically, or physically controls aquatic vegetation in the immediate vicinity of a boat landing or bathing beach on or adjacent to the real property of the landowner or tenant if the following conditions exist:
(A) The area where vegetation is to be controlled does not exceed:
(i) twenty-five (25) feet along the legally established, average, or normal shoreline;
(ii) a water depth of six (6) feet; and
(iii) a total surface area of six hundred twenty-five (625) square feet.
(B) Control of vegetation does not occur in a public waterway of the state.
(b) A person may not chemically, mechanically, physically, or biologically control aquatic vegetation in the public waters or boundary waters of the state without a permit issued by the department. All procedures to control aquatic vegetation under this section shall be conducted in accordance with rules adopted by the department under IC 4-22-2.
(c) Upon receipt of an application for a permit to control aquatic vegetation and the payment of a fee of five dollars ($5), the department may issue a permit to the applicant. However, if the aquatic vegetation proposed to be controlled is present in a public water supply, the department may not, without prior written approval from the department of environmental management, approve a permit for control of the aquatic vegetation.
(d) This section does not do any of the following:
(1) Act as a bar to a suit or cause of action by a person or governmental agency.
(2) Relieve the permittee from liability, rules, restrictions, or permits that may be required of the permittee by any other governmental agency.
(3) Affect water pollution control laws (as defined in IC 13-11-2-261) and the rules adopted under water pollution control laws (as defined in IC 13-11-2-261).
As added by P.L.1-1995, SEC.15. Amended by P.L.1-1996, SEC.64.

312 IAC 9-10-3 Aquatic vegetation control permits
Authority: IC 14-22-2-6; IC 14-22-9-10
Affected: IC 14-22-9-10

Sec. 3. (a) Except as provided under IC 14-22-9-10(a), a person shall obtain a permit under this section before applying a substance to waters of this state to seek aquatic vegetation control.
(b) An application for an aquatic vegetation control permit shall be made on a departmental form and must include the following information:
(1) The common name of the plants to be controlled.
(2) The acreage to be treated.
(3) The maximum depth of the water where plants are to be treated.
(4) The name and amount of the chemical to be used.
(c) A permit issued under this section is limited to the terms of the application and to conditions imposed on the permit by the department.
(d) Five (5) days before the application of a substance permitted under this section, the permit holder must post clearly, visible signs at the treatment area indicating the substance that will be

applied and what precautions should be taken.

(e) A permit issued under this section is void if the waters to be treated are supplied to the public by a private company or governmental agency. *(Natural Resources Commission; 312*

16.5 Public Input Questionnaire

Table 16: 2006 Public Questionnaire

Total: 46

Lake Use Survey — Lake name Waubee

Are you a lake property owner? Yes 43 No 3

Are you currently a member of your lake association? Yes 45 No 0

How many years have you been at the lake?
- 2 or less – 8
- 2 – 5 years - 8
- 5-10 years - 6
- Over 10 years - 24

How do you use the lake (mark all that apply)
- 33 Swimming
- 37 Boating
- 39 Fishing
- 22 Irrigation
- 1 Drinking water
- 0 Other

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 19 No 21

Do you currently participate in a weed control project on the lake? Yes 10 No 32

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 11 No 30 Somewhat 2

Does the level of vegetation in the lake affect your property values? Yes 6 No 33

Are you in favor of continuing efforts to control vegetation on the lake? Yes 41 No 2

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 27 No 15

Mark any of these you think are problems on your lake:
- 5 Too many boats access the lake
- 4 Use of jet skis on the lake
- 2 Too much fishing
- 10 Fish population problem
- 5 Dredging needed
- 4 Overuse by nonresidents
- 8 Too many aquatic plants
- 0 Not enough aquatic plants
- 0 Poor water quality
- 0 Pier/funneling problem

Please add any comments:
need more fish; beach needs supervision; zebra muscles seem to be excessive; they reduce quality of bottom... sharp when stepped on; glad we have a speed limit; maintain lake level; too low; lake water level receding too much for access to channel; problems with excess speed

16.6 Species Distribution Maps

*Rake scores for each site where a species was collected are included.

Figure 5: 2006 Brittle Naiad Sites

Figure 6: 2006 Chara Sites

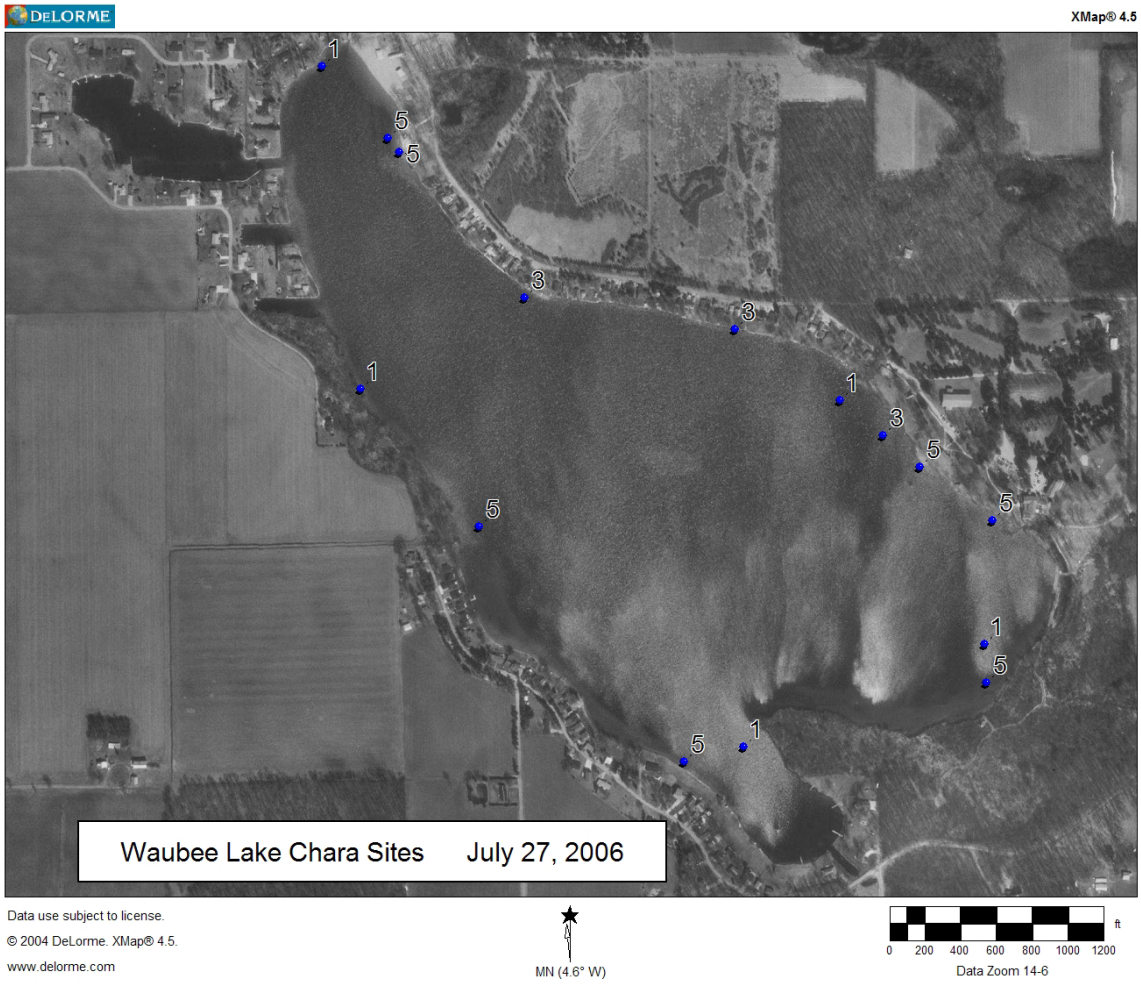


Figure 7: 2006 Coontail Sites

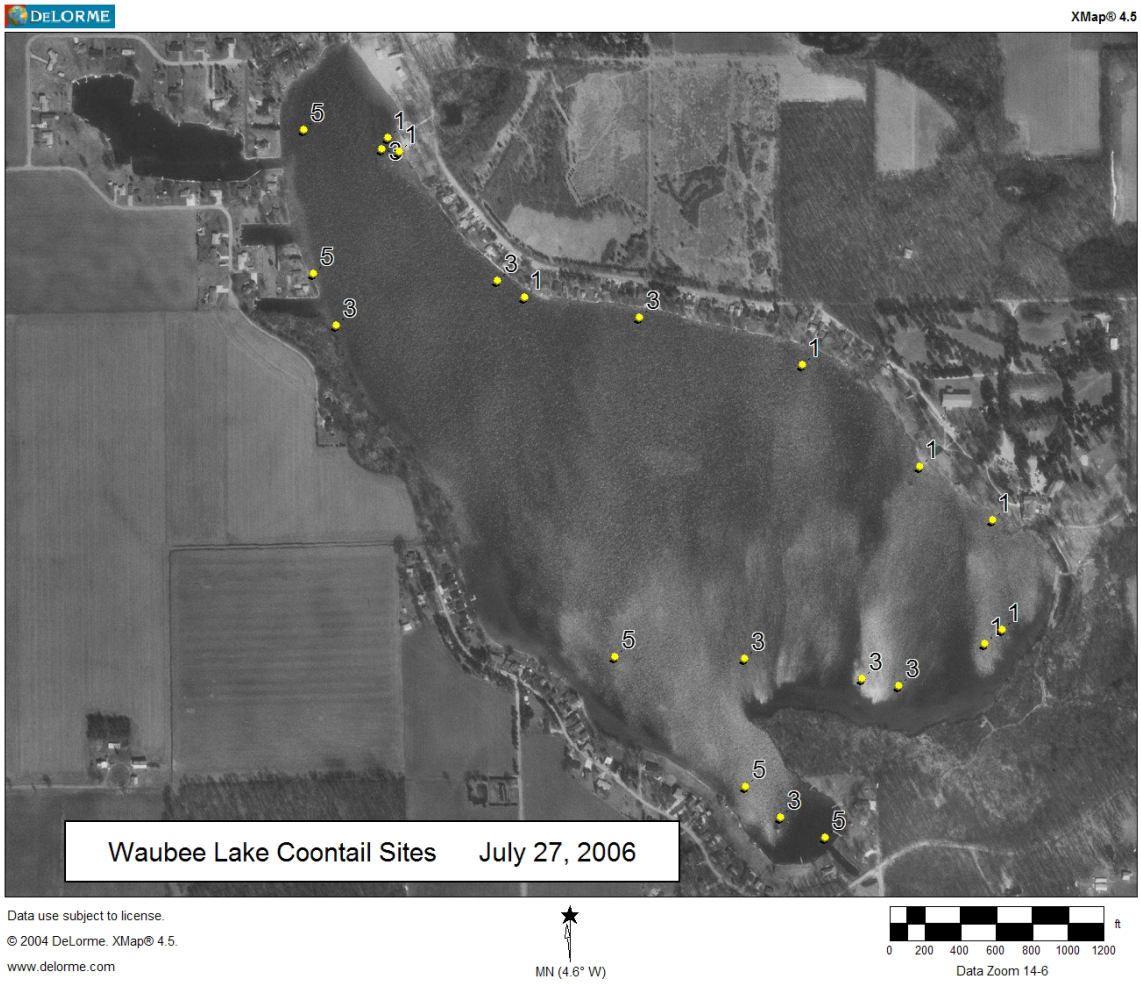


Figure 8: 2006 Eurasian Watermilfoil Sites

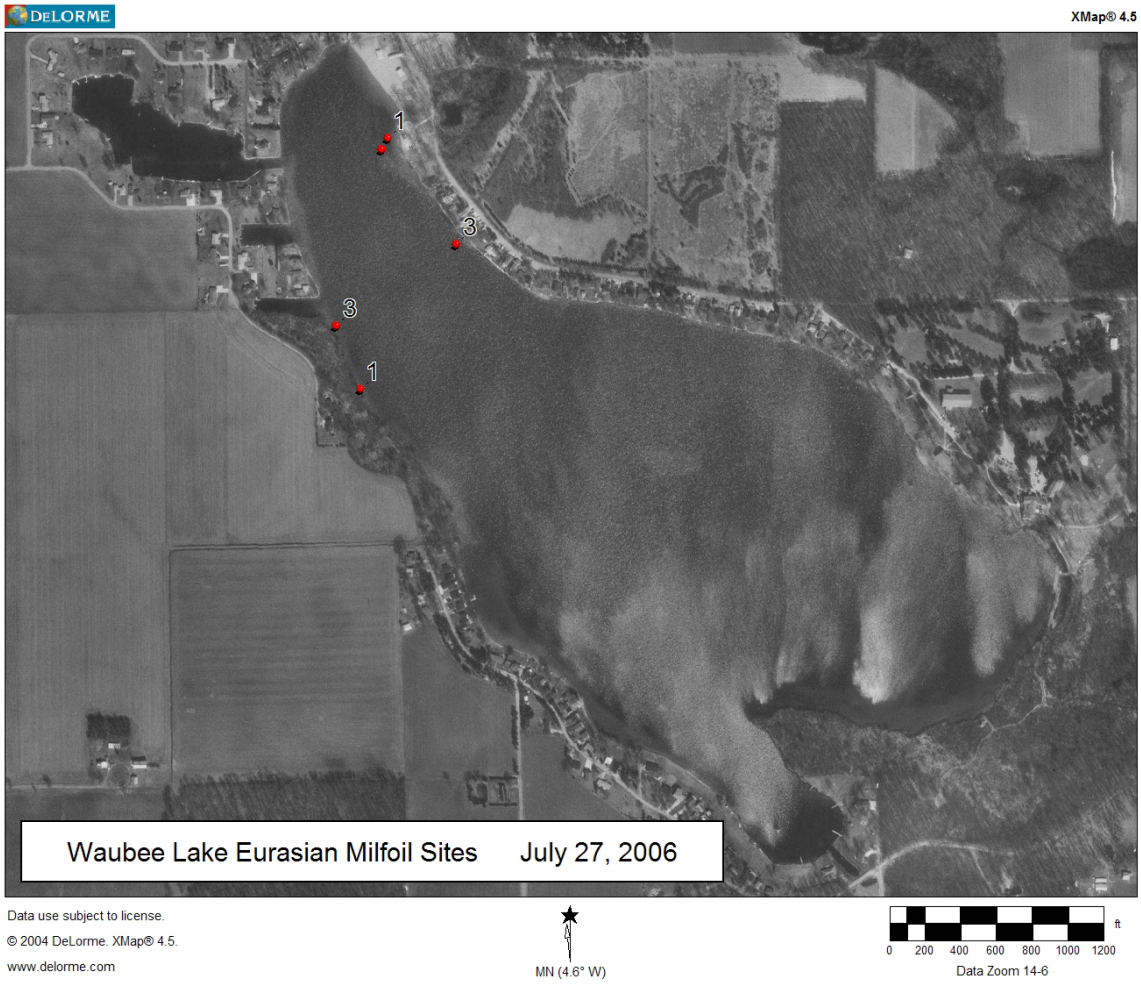


Figure 9: 2006 Eelgrass Sites

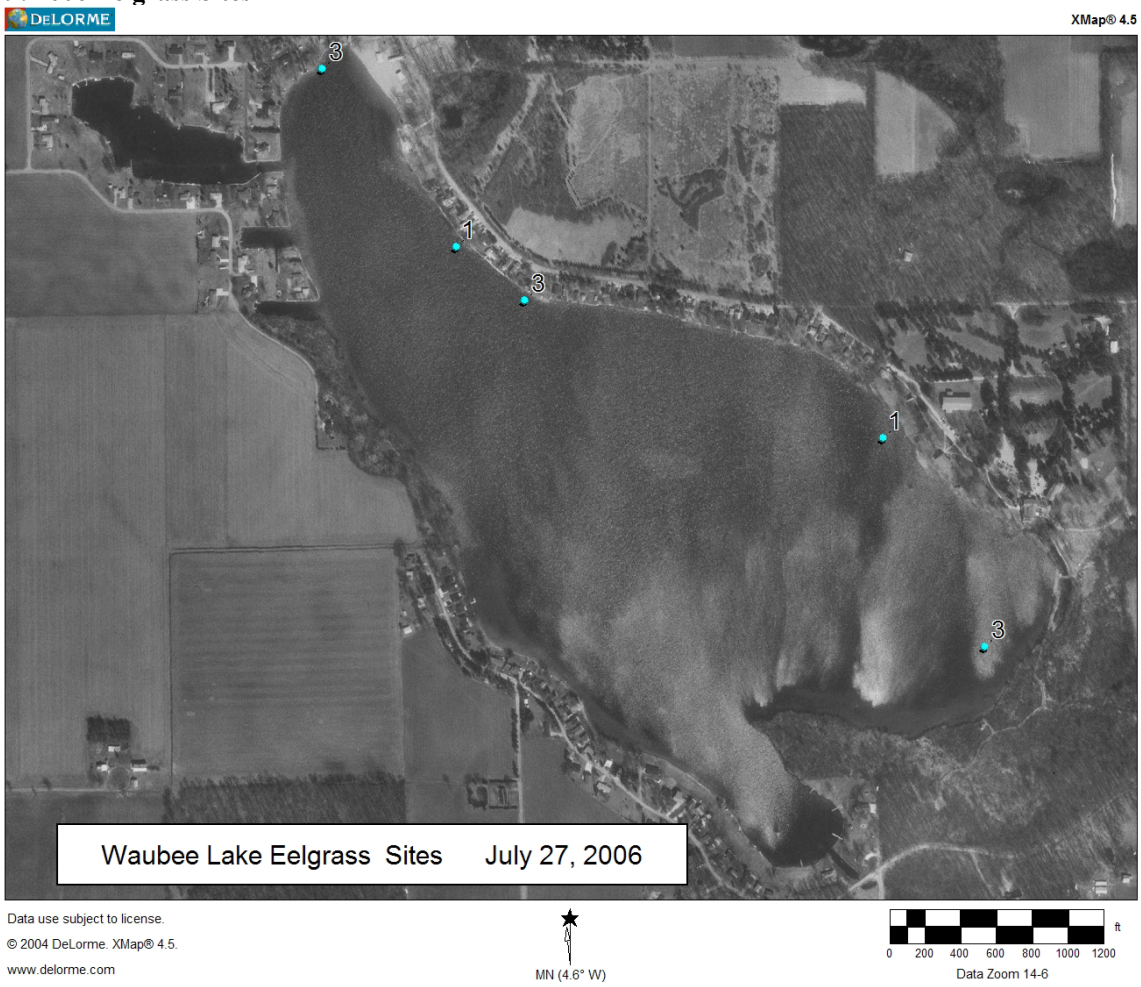


Figure 10: 2006 Flat-stemmed Pondweed Sites

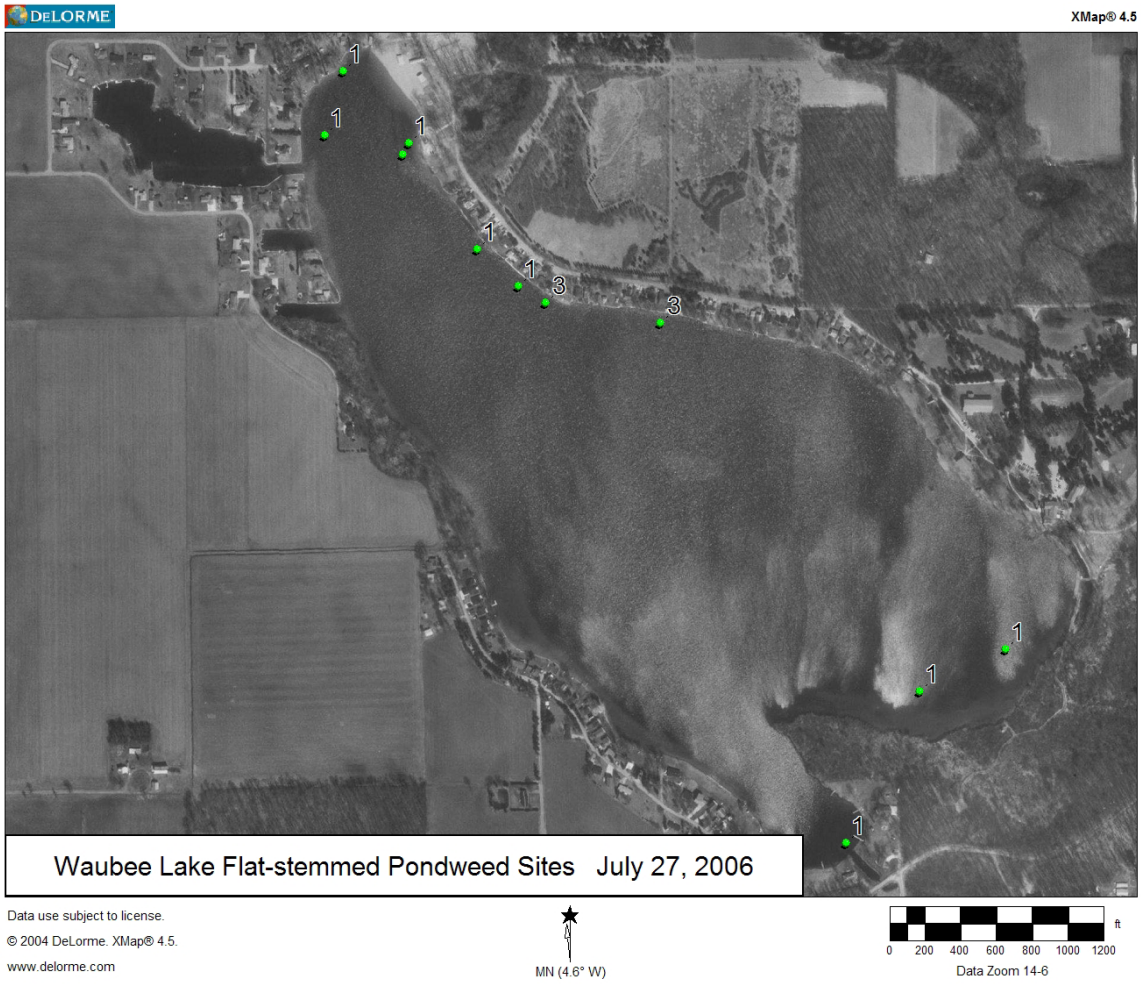


Figure 11: 2006 Illinois Pondweed Sites

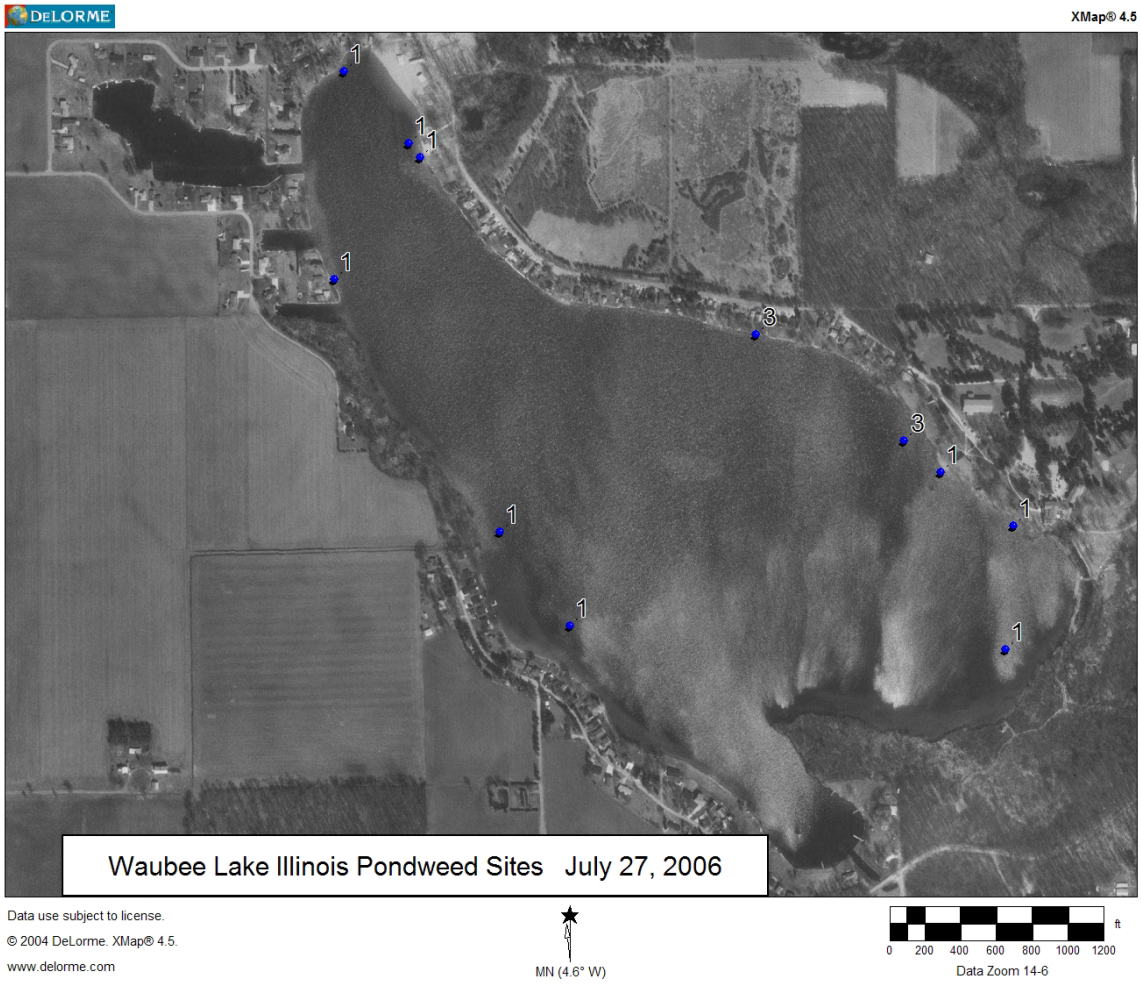


Figure 12: 2006 Sago Pondweed Sites

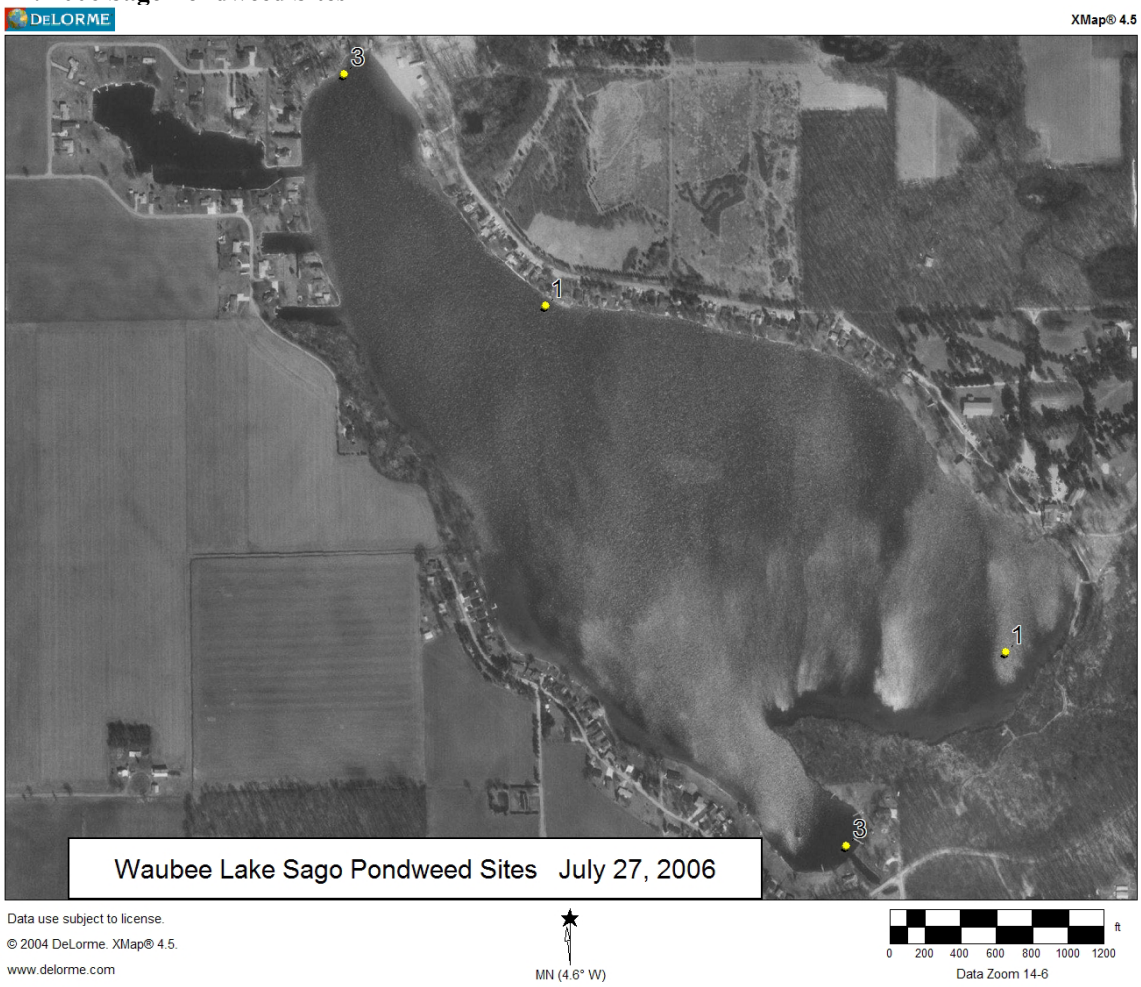


Figure 13: 2006 Slender Naiad Sites

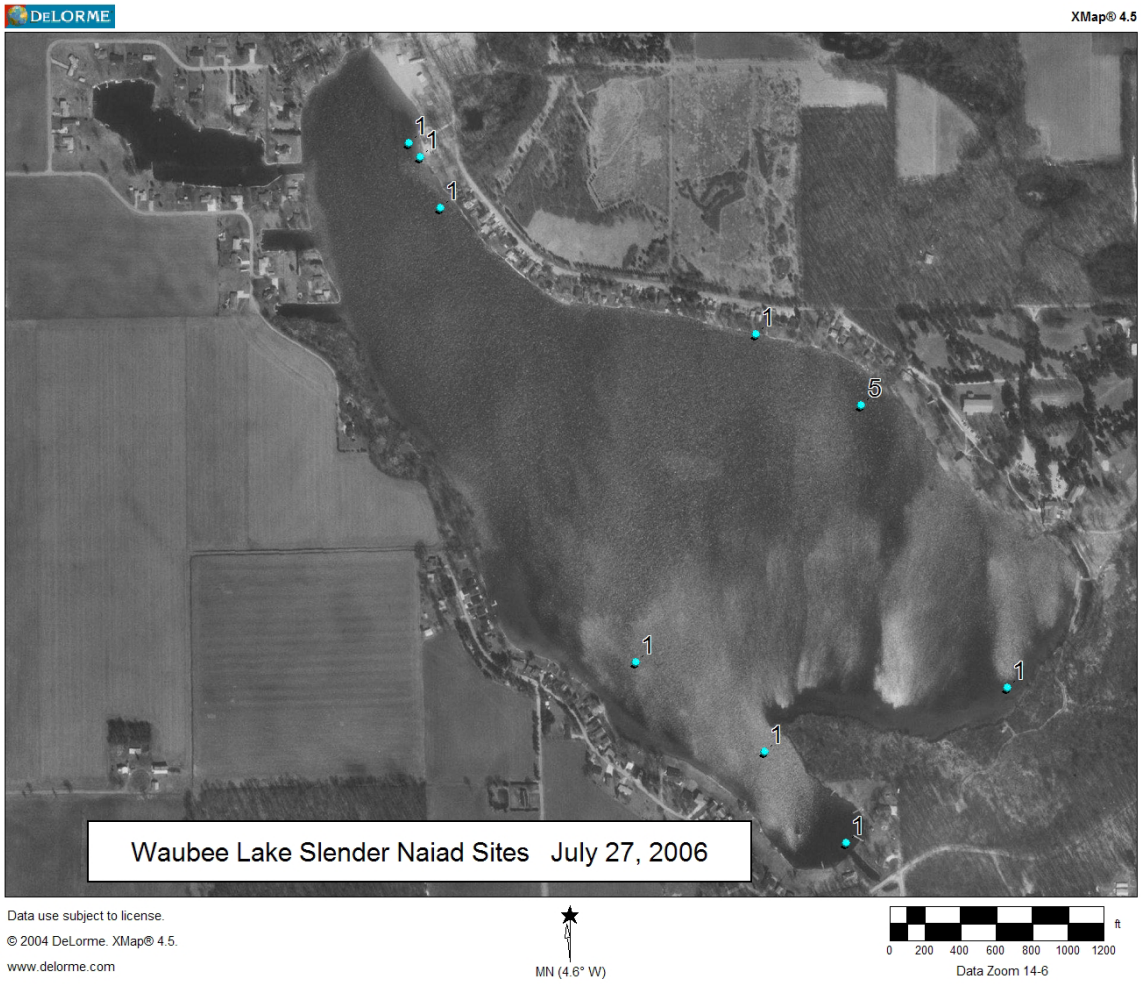
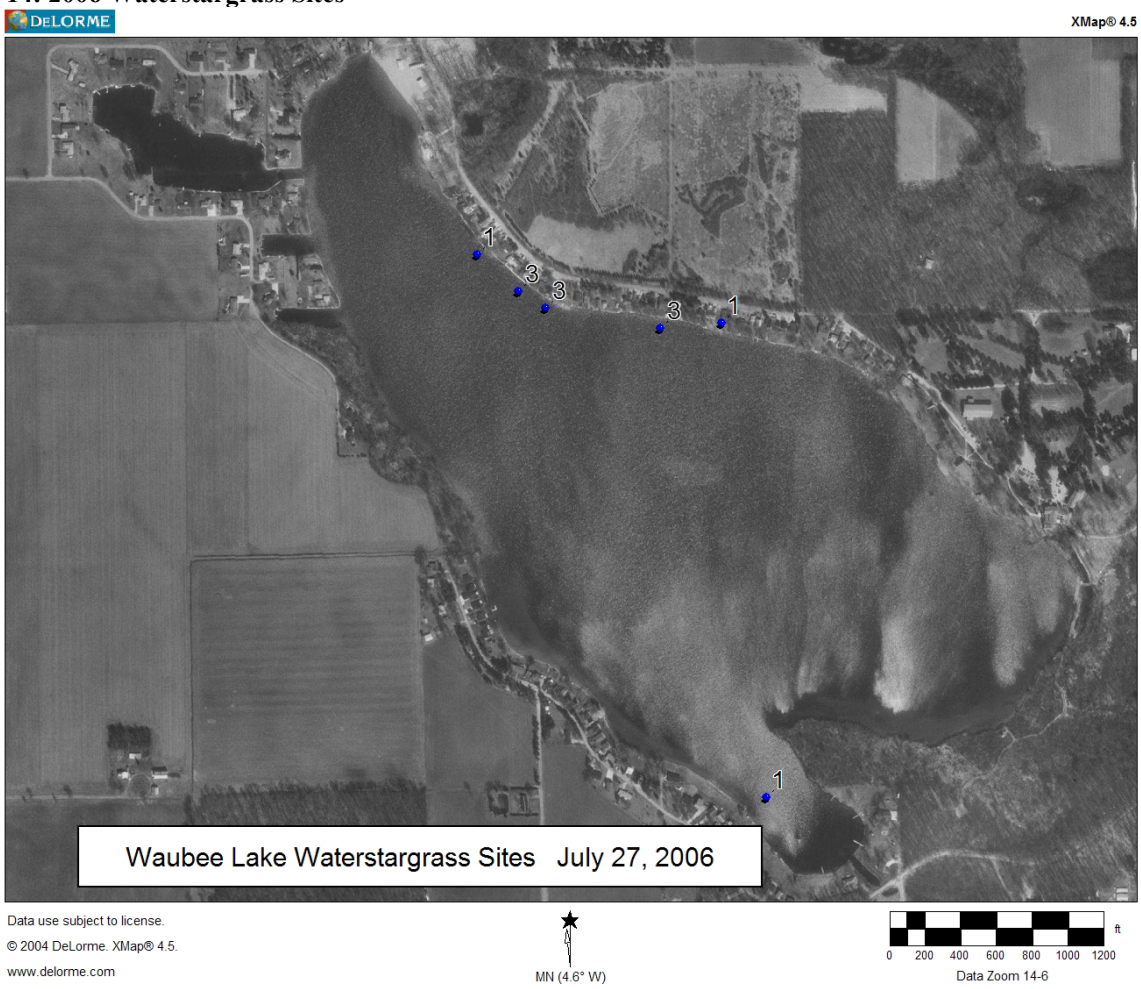


Figure 14: 2006 Waterstargrass Sites



16.8 Data sheets

Table 17: 2006 Tier II Data Sheet Page 1

Submersed Aquatic Plant Survey Form

Page 1 of 2

WATER BODY NAME	Waubee Lake				SECCHI	9 ft									
COUNTY	Kosciusko				MAX PLANT DEPTH	25 (19)									
DATE	July 27, 2006				WEATHER	Cloudy/Rain calm - upper 80's									
CREW LEADER	Dave				COMMENTS										
RECORDER	Dave														
					Rake score (1-5), observed only (9), algae present (p)										
					Use acronyms for species, V1, V2...for voucher codes										Note
					Species Code										
Site	Northing	Easting	Depth	All	CHARA	CEDEW	MYSPI	POZO	POIL	NAFL	UAAM	POPEG	NAMI	ZOZO	
1	GPS WayPoints		2	5	5	1	1	1	1	1					
2			6	5	1			1	1		3	3	3		
3			11	5		5		1							
4			19	0											
5			24	0											
6			3	5		5			1						
7			9	5		3	3								
8			11	1	1		1								
9			16	0											
10			24	0											
11			3	5	5				1				1		
12			8	5									5		
13			12	3					1				3		
14			17	5		5				1					
15			21	0											
16			4	5	5								1		
17			7	5		5								1	
18			11	3		3									
19			6	5		5		1		1		3			
20			6	5	1					1			5		
21			19	3		3									
22			22	0											
23			12	3		3									
24			16	3		3		1							
25			22	0											
26			2	5	5					1			1		
27			7	5	1	1		1	1		3	1	5		
28			16	1		1									
29			19	0											
30			25	0											
31			4	5	5	1			1						
32			11	0											
Other plant species observed at lake															

Table 18: 2006 Tier II Data Sheet Page 2

Submersed Aquatic Plant Survey Form

Page 2 of 2

WATER BODY NAME	Wauber	Lake			SECCHI	9 ft								
COUNTY	Kosciusko				MAX PLANT DEPTH	25 (19)	ft							
DATE	July 27, 2006				WEATHER	cloudy/Rain	calm, upper 80's							
CREW LEADER	Dave				COMMENTS									
RECORDER	Dave													
					Rake score (1-5), observed only (9), algae present (p)									
					Use acronyms for species, V1, V2...for voucher codes									Note
					Species Code									
Site	Northing	Easting	Depth	All	CHAG	CEDEU	NYSPS2	POZO	POIL	NITL	VAAM3	POPE6	NAMI	2ODU
33	GPS Waypoints		25	0										
34	↓	↓	2	5	5	1			1					
35			8	5	3				3		1		3	
36			11	5	1					5				
37			18	1		1								
38			24	0										
39			4	5	3				3	1				
40			8	1										1
41			12	5		3		3						3
42			19	0										
43			24	0										
44			4	5	3	1		3			3	1		3
45			6	5		3		1						3
46			12	3			3	1			1			1
47			17	1						1				
48			21	0										
49			1	5	5	1			1	1				
50			11	3		3	1	1						
	Bay													
1			6	5	1								5	
2			8	3					1	1	3			
3			9	5							5			
Other plant species observed at lake														

Aquatic Vegetation Plant Bed Data Sheet

Page 1 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Wawbee Lake

DATE: 5/17/06

SITE INFORMATION

Plant Bed ID: 01

Bed Size: 7.8 acres

Substrate: 3

Marl? 1

High Organic? 0

Waterbody Name: Wawbee Lake

Waterbody ID:

Total # of Species 4

Canopy Abundance at Site: S: 4 N: – F: – E: –

SITE COORDINATES

Center of the Bed

Latitude: N41 23.604

Longitude: W86 50.258

Max. Lakeward Extent of Bed

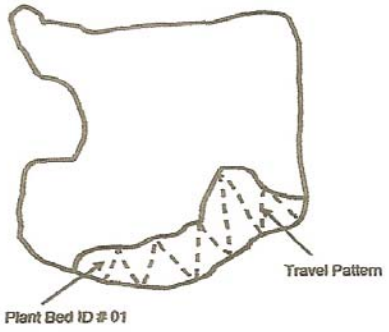
Latitude: N41 23.614

Longitude: W86 50.251

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POCR3	1			
CHAR	2			
MYSP2	2			
ZODU	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 2 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Wauber Lake

DATE: 5/17/06

SITE INFORMATION

Plant Bed ID: S2

Bed Size: 7.5 acre

Substrate: 3

Marl? 0

High Organic? 1

Waterbody Name: Wauber Lake

Waterbody ID:

Total # of Species 3

Canopy Abundance at Site

S: 4 N: - F: - E: -

SITE COORDINATES

Center of the Bed

Latitude: N41 23.700

Longitude: W86 50.470

Max. Lakeward Extent of Bed

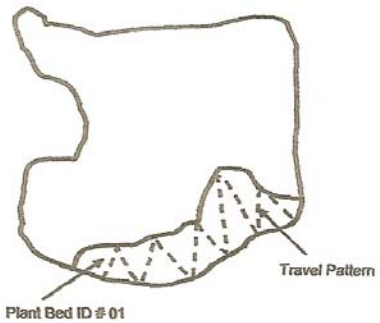
Latitude: N41 23.658

Longitude: W86 50.775

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHAR	1			
MYSP2	2			
POTA2	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varified

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 3 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Wawasee Lake

DATE: 5/17/06

SITE INFORMATION

Plant Bed ID: S 3

Bed Size: 5.5 acres

Substrate: 3

Marl? 1

High Organic? 0

Waterbody Name: Wawasee Lake

Waterbody ID:

Total # of Species: 4

Canopy Abundance at Site

S: 4 N: — F: — E: —

SITE COORDINATES

Center of the Bed

Latitude: N41 23.252

Longitude: W85 50.022

Max. Lakeward Extent of Bed

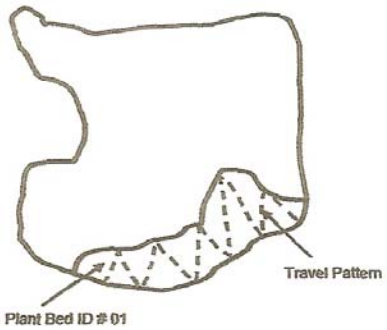
Latitude: N41 23.271

Longitude: W85 50.008

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POIL	1			
MYSP2	1			
CHTAR	3			
CEDEH	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 4 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Wawbee Lake

DATE: 5/17/06

SITE INFORMATION

Plant Bed ID: 45

Bed Size: 7.3 acres

Substrate: 1

Marl? 0

High Organic? 1

Waterbody Name: Wawbee Lake

Waterbody ID:

Total # of Species 6

Canopy Abundance at Site

S: 4 N: 1 F: – E: –

SITE COORDINATES

Center of the Bed

Latitude: N41 23.069

Longitude: W86 49.666

Max. Lakeward Extent of Bed

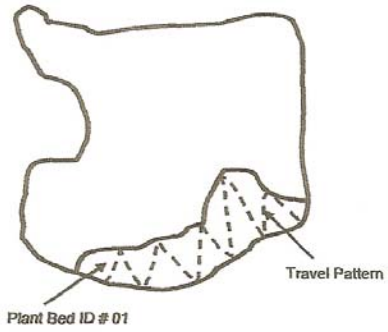
Latitude: N41 23.115

Longitude: W86 49.730

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POCR 3	4			
MYSPZ	3			
CHARA	1			
POPE6	1			
CEDE4	2			
LEMN	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 5 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Wauber Lake

DATE: 5/17/06

SITE INFORMATION

Plant Bed ID: 5

Waterbody Name: Wauber Lake

Bed Size: 4.8

Substrate: 3

Waterbody ID:

Marl? 1

Total # of Species 4

High Organic? 0

Canopy Abundance at Site

S: 4 N: – F: – E: –

SITE COORDINATES

Center of the Bed

Latitude: N 41 23.158

Longitude: W 85 49.436

Max. Lakeward Extent of Bed

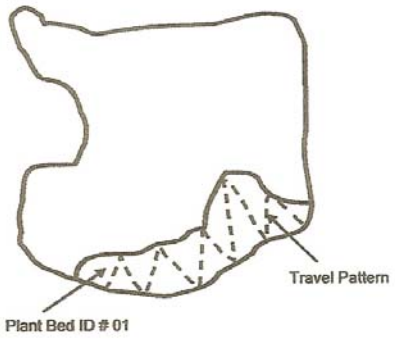
Latitude: N41 23.174

Longitude: W85 49.441

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POCR3	1			
CHTAR	3			
POIL	1			
CEDE4	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 6 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Wawbee Lake

DATE: 5/17/06

SITE INFORMATION

Plant Bed ID: 5 6

Bed Size: 4.6

Substrate: 3

Marl? 1

High Organic? 0

Waterbody Name: Wawbee Lake

Waterbody ID:

Total # of Species 6

Canopy Abundance at Site

S: 4 N: – F: – E: –

SITE COORDINATES

Center of the Bed

Latitude: 23,519

Longitude: 49,803

Max. Lakeward Extent of Bed

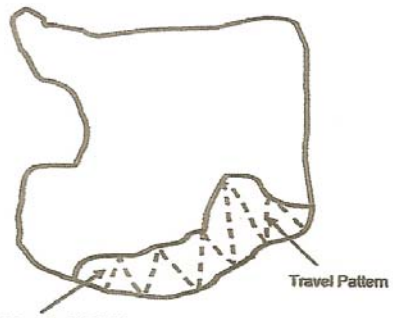
Latitude: 25,530

Longitude: 49,950

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
LARGE	1			
CEDE 4	1			
POCR 3	1			
CHARA	2			
ZODU	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varified

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

16.9 IDNR Aquatic Vegetation Permit

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R4 / 2-04)
Approved State Board of Accounts 2004
[ ] Whole Lake [X] Multiple Treatment Areas
Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

Return to: Page 1 of
DEPARTMENT OF NATURAL RESOURC
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W2
Indianapolis, IN 46204

FEE: $5.00

Applicant's Name	Lake Assoc. Name	
	Wabee Lake Association	
Rural Route or Street		Phone Number
P. O. Box 275		574-658-4289
City and State		ZIP Code
Milford IN		46542
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake)	Nearest Town	County
Wabee	Milford	Kosciusko
Does water flow into a water supply		[ ] Yes [X] No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply int

Treatment Area #	1	LAT/LONG or UTM's	N41degrees 23.350 W85 degrees 49.913
Total acres to be controlled	20	Proposed shoreline treatment length (ft)	entire Bay
Maximum Depth of Treatment (ft)	5	Expected date(s) of treatment(s)	Mid June

Perpendicular distance from shoreline (ft): entire E

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Renovate

Plant survey method: [ ] Rake [X] Visual [ ] Other (specify)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Chara		45
Curly Leaf		33.3
Eurasian Milfoil	X	16.7
Naiad		16.7
Coontail		13.3
Illinois		1.7
Sago		1.7

Page ___ of

Treatment Area # 3	LAT/LONG or UTM's N41 degrees 23.578 W85 degrees 50.312		
Total acres to be controlled 0.25	Proposed shoreline treatment length (ft) 75	Perpendicular distance from shoreline (ft) 150	
Maximum Depth of Treatment (ft) 5	Expected date(s) of treatment(s) mid June		

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Renovate

Plant survey method: [ ] Rake [ ] Visual [ ] Other (specify)

	Check if Target Species	Relative Abundance % of Community
Chara		45
Curly Leaf		33.3
Eurasian Milfoil	X	16.7
Naiad		16.7
Coontail		13.3
Illinois		1.7
Sago		1.7

INSTRUCTIONS: Applicant must sign the application and is the only signature required. If applicant is also a certified chemical applicator, sign the "certified applicator" signature box

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY

[ ] Approved [ ] Disapproved	Fisheries Staff Specialist
[ ] Approved [ ] Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

Page ____ of

Treatment Area #	5	LAT/LONG or UTM's	N41 degrees 23.111 W85 degrees 49.802		
Total acres to be controlled	3.44	Proposed shoreline treatment length (ft)	1000	Perpendicular distance from shoreline (ft)	150
Maximum Depth of Treatment (ft)	5	Expected date(s) of treatment(s)	mid June		

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Reward, Aquathal k, Copper Sulfate, 2-4D, renovate, Nautique

Plant survey method: [ ] Rake [X] Visual [ ] Other (specify)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Chara		45
Curly Leaf		33.3
Eurasian Milfoil	X	16.7
Naiad		16.7
Coontail		13.3
Illinois		1.7
Sago		1.7

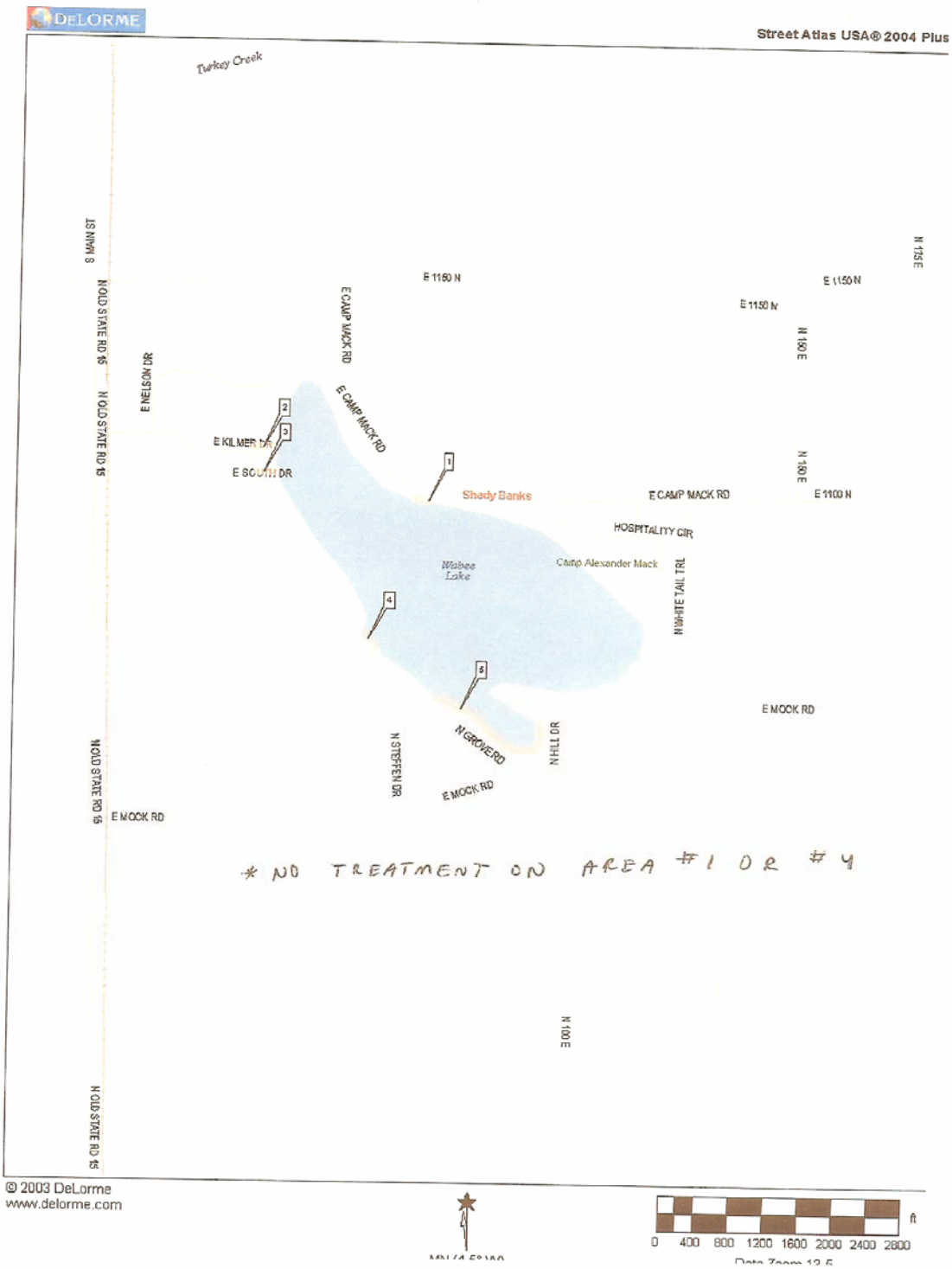
Treatment Area #	2	LAT/LONG or UTM's	N41 degrees 23.640 W85 degrees 50.319		
Total acres to be controlled	0.229	Proposed shoreline treatment length (ft)	100	Perpendicular distance from shoreline (ft)	100
Maximum Depth of Treatment (ft)	5	Expected date(s) of treatment(s)	Mid June		

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Renovate

Plant survey method: [ ] Rake [X] Visual [ ] Other (specify)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian Milfoil	X	80
Curley Leaf		10
Richardson Pondweed		10


DeLORME
Street Atlas USA® 2004 Plus
Turkey Creek
E 1150 N
E CAMP MACK RD
E NELSON DR
E KILMER DR
E SOUTH DR
Shady Banks
E CAMP MACK RD
E 1100 N
HOSPITALITY CIR
Wabee Lake
Camp Alexander Mack
N WHITE TAIL TRL
E MOCK RD
N GROVE RD
N STEFEN DR
N HILL DR
N OLD STATE RD 15
N 100 E
N 150 E
N 175 E
* NO TREATMENT ON AREA #1 OR #4
© 2003 DeLorme
www.delorme.com
0 400 800 1200 1600 2000 2400 2800 ft